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From the Counting Stones of the Romans

Came Our Word

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In This Issue—Hundreds of Articles and Pictures Tell the Latest News of Laboratory Discoveries, Scientific Triumphs, and Amazing New Inventions

HOW TO GET PARTS FOR MAKING A BEAUTIFUL. GALLEON MODEL

Whether you have ever built a ship model or not, here is your chance to make one of the most decorative and colorful little vessels ever designed-the POPULAR SCIENCE MONTHLY Spanish Galleon. Complete kits of selected materials have been prepared under the supervision of the Popular Science Homecraft Guild for distribution at the specially low price of \$6.45 each.

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You will find an illustration of the model on page 90 of this issue. Thousands of readers have already built it successfully; in fact, it has been by far our most popular ship model. Heretofore, however, everyone has had to spend hours shopping for the necessary materials, some of which are hard to obtain even in the larger cities. and the cost, naturally, has been high. A coupon is given below, but if you do not wish to cut the magazine, you may order by writing a separate letter.

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Many a pipe smoker spends years in his search for the "perfect" tobacco. Once discovered, however, will that tobacco remain uniformly the same, package after package, year after year? That is what every pipe smoker wants to know, and that is why it is good news when R. K. Wheeler of Dayton, Ohio, writes that in 16 years "I have never purchased a single package of Edgeworth whose flavor and aroma differed in the least from another. His complete letter will interest smokers.

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So I too say, "Keep up the good work," for it would be a sad day for pipe smokers should Edgeworth disappear from the tohacco shops,

Yours truly, R. K. Wheeler

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IS MY Insurance SAFE

By LEON MEADOW, Financial Editor

"TET the women play bridge. It's a darn sight cooler out here," said Jack Kennedy, tipping back his chair and putting his feet on the porch

"You're right," came a voice from the dark, where the glow of a cigar was the only indication that someone was actually there. It was Ted Jackson. "And besides, he continued, "who can keep his mind on bridge these days? I can't—too much to think about."

Frank Quinn, quiet up till this point, joined the conversation. "Just thinking about it won't do you much good," he said. "What's on your mind, Ted?" asked Kennedy.

"Well, here I've put in two years reconciling myself to changing conditions, adjusting myself to new standards and all that. Now I reach the point where I've decided I can account for the worst that may happen and am willing to take it as it comes. In other words, I'm ready to stand pat on what's gone before in the way of losses, and to start out anew. What happens? Several large life insurance companies start to cut their dividends. No matter how bad things have been, I've always believed that my life insurance would be safe-nothing could disturb that, Now, with these dividends cut, I'm beginning to worry about insurance too.

Jack Kennedy interrupted. "I don't know how much you have to worry about, Ted-but, if I were you, I wouldn't go out of my way to pick up additional worries. Anyway, I think I can erase this bugaboo for you without much trouble. Life insurance companies are safe. That is, of course, all reputable ones."

"YOU know more about these things than we do," put in Frank Quinn, "but I'm like Ted. I need more convincing. All I know is that insurance companies sink most of their income into securities and mortgages-and no matter how carefully or conservatively they've picked 'em, they must be in the hole, same as

everybody else."
"Well boys." Kennedy answered, "I'm
no financial wizard, but I think I do
know enough about insurance companies to convince you of their safety. Do you want to be convinced?". Both men said they did, so Kennedy continued:

"I'll answer Frank first. That seems the best way to start. About 35% of all insurance companies' assets are in domestic stocks and bonds-mostly bonds-and about 2 or 3% in foreign securities. Almost 40% are in mortgages. On the face of it, then, it would seem that insurance companies have taken a pretty bad lick-ing. But the peculiar part of it is that the ups and downs of the security and real estate markets have far less to do with the affairs of a life insurance com-

pany than most people think."
"How so, Jack?" interrupted Ted Jack-

"I THINK the best way to prove that is by a simple comparison between an insurance company and a commercial bank. There's one tremendous difference, you know, between these two organiza-tions, and that difference is one of the

factors that make the insurance company so safe. Banks must keep their assets in a 'liquid' condition, because it is quite possible that at any given moment they will be called upon to pay out a great part, or even all, of their deposits. The sad experiences of the last two years have taught us how easily that can happen. Because of this condition, the state of the security and real estate market at any given time is of vital importance to a bank. If it's forced to liquidate in bad times, you have trouble-and plenty of

"On the other hand, the assets of an insurance company are not subject to such hazards. They never experience runs, panics or public hysteria. It's very simple. An insurance company writes a policy for a man-and on the average, its debt to him is not payable for fifteen or twenty years. A bank takes a deposit from a man, invests it, and the next day he turns up for his money. There's a vast difference there. The insurance company does not depend on market fluctuations because its assets do not have to be liquidated on short notice. Investments made by insurance companies are long-term affairs, bearing definite interest till a definite maturity date. Fluctuations between the dates of purchase and maturity don't mean anything. Even the law recognizes this and allows the life insurance companies to value their bonds on an amortization basis -which means at a value consistent with their purchase price."

"That's very true, Jack," Quinn said. "Hadn't thought about it from that angle

IS MY INSURANCE SAFE?

(Continued from page 6)

before. But insurance companies must sustain some losses in income in times like these. I mean stock dividends have been cut tremendously and there have been so many defaults on bonds and mortgages,'

"Right enough," Kennedy replied, "there has been some decrease in interest earnings, and this is the chief reason for these dividend cuts. But do you know that if every cent of income from investments in stocks and bonds and mortgages had been cut off in 1931, insurance companies would still have had enough coming in in premiums to pay out all demands for the year? The other day I was talking to a man representing a fairly large company. He showed me the bal-ance sheet for 1931. Company took in \$36,000.000 in premiums and paid out something like \$24,000,000 in matured policies, in face value on deaths-and in policy loans. And what's more, that last item of policy loans can't really be considered as money paid out-but as an investment—and certainly the safest of

HOW do you make that out?" asked

"Like this, Ted-a man borrows on the full loan value of his policy. If he pays his 6% interest—well and good. If he doesn't pay it, the charge is automatically deducted from the remaining equity in the policy. If he never pays it-the final reckoning comes at the time of his death, when it will be found that, sadly enough, there is a difference between what his beneficiary should get-and does get.

"I give in," interrupted Frank, with a short laugh. "That certainly seems to be enough of a safety factor for any one."

"It should be," answered Kennedy, pausing to light a cigarette. "But in case it isn't," he continued, "there are still a number of other factors that combine to make your insurance even safer. Let's go back to the remark which started this whole discussion-dividend cuts. If an insurance company should cut out their dividend entirely for one year, they could conserve about 15% of their premium income. Think that over for a minute. It means that even if their investments go sour, even if their policy lapses are tremendous and even if they must pay out an unusually large amount on death claims or matured policies, there is still this way of conserving their income. For what purpose? To preserve their guarantee to you -in event of your death-to pay the full amount of your policy. Wouldn't you take a dividend cut to insure that? Good Lord," he added vehemently, "how many people in this country would gladly have accepted dividend cuts on their stock investments-if it meant protecting the face value of them? How many people have taken dividend cuts and still lost every cent they put into them?"

The men remained silent for a few minutes; each was absorbed in his own thoughts. Then Frank Quinn said, "Talking about death claims and matured poli-

cies, have (Continued on page 8)

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OCTOBER, 1932 7

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IS MY INSURANCE SAFE?

(Continued from page 7)

insurance companies any way of telling or judging approximately how much they will have to pay out in a year?"

"Yes, they have," replied Kennedy. "They can forecast these things with close approximation by means of their mortality tables. Incidentally, that brings up another safety factor in favor of life insurance companies. In this country the death rate for the public at large is higher than that of life insurance policy holders. One reason for this is the medical selection and acceptance of people who are likely to have long lives. The unfit are rejected. Consequently the actual number of death claims on which a company pays out during a year runs lower than their expected mortality, according to the tables. And the rates, you know, are governed by these tables. This means an annual savings to policy holders-and part of it is returned in dividends, the rest being invested in surplus."

"You certainly are piling up evidence for your case, Jack," Ted Jackson said. "I'm beginning to feel much safer about the situation. Anything else you add will just about clinch the argument."

"Well," his host replied, with a smile, "I haven't finished yet-if that's what you mean! Another safety factor with life insurance companies is their practice of using a conservative rate of interest in their premium calculations. Although they have for years earned about 5%, they have used only 3 or 31/2%.

NOW, let's return to this question of capital investment. Certainly the depression has hit the investments of insurance companies, as well as every one else's. About 10% of their money is in farm mortgages. The farmer has been hit hard. Yet, I have seen figures showing that 75% of these mortgages, even today, are returning interest payments. Insurance companies rarely loan on more than 50% of the appraised value of property. So, even if they have to foreclose on 20 or 25% of farm property mortgages—the equity is certainly large enough to make those frozen assets worthwhile to the company when they thaw out in good times. The best part about it, as I said before, is that they don't have to liquidate. Insurance companies can sit tight in bad times—and wait for better days. As far as other mortgages are concerned, the great majority of them are in personal homes and not in office buildings and hotels. where rental incomes have been badly reduced. So that the same condition holds

true for this type of mortgage.
"All right, Jack, but what's happened to their bond holdings?" asked Frank

Ouinn. "I was coming to that," Kennedy replied. "About one fifth of them are in U. S., Canadian, Municipal and other

Government Bonds. Insurance Companies have invested comparatively little in bonds of other foreign countries. The greatest part of the remainder are in railroad and utility issues. But that's not as much cause for alarm as you (Continued on page 9)

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IS MY INSURANCE SAFE?

(Continued from page 8)

would think. In the case of railroads, insurance company holdings are comprised mostly of underlying issues or virtual mortgages on main routes of travel—ones that would suffer but little, even in the event of receivership. Practically the same thing is true of their public utility holdings which are not the ordinary run of bonds of holding companies, but are actually liens on power plants and commanies.

"All these investments, regardless of market prices, are essentially and fundamentally sound, gilt-edge holdings. They will come back to par. And since insurance companies can hold on and do not have to liquidate, their assets are practically

100% safe."

Ai this point Jack's wife, Martha, stuck her head out of the porch door and made a poor attempt to glare at the men. 'Are you fellows going to continue settling the nation's affairs,' she said, 'or are you going to be sensible enough to come in and have some refreshments while they last; I've been calling you for the last five minutes."

"Coming now, Martha," Jack answered. The men got up, and, as they were going inside, Kennedy added, "By way of final proof, stick this in your pipes and smoke it: In the last fifty years, no reputable and important life insurance company in the United States has failed."

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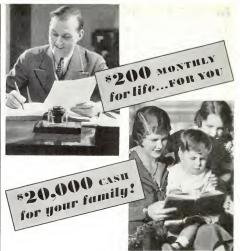
The Investment Aspect of Life Insurance, by M. A. Linton, presents life insurance as an exceedingly worth-while investment as well as a form of protection. Provided Mutual Life Insurance Company of Philadelphia, Pennsylvania, will mail a complimentary copy upon request.

Before 65 and After explains the full details of a Retirement Income, with full Life Insurance, Disability and Double Accident benefits. Sent on request by The Equitable Life Assurance Society, 393 Seventh Avenue, New York Giv.

How to Get the Things You Want tells how you can use insurance as an active part of your program for getting ahead financially. Phoenix Mutual Life Insurance Company, 328 Elm Street, Hartford, Conn., will send you this booklet on request.

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case you should die before the income begins.

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\$100 A MONTH if before reaching age 55 you suffer prolonged total disability. You will also be relieved of paying premium deposits as long as such disability lasts. This clause is not available to men over 50.

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OCTOBER, 1932

Our Readers

Just Think of It! Another Publication Is Wanted

ALLOW me to make a suggestion and let us see what other readers have to say about it. I move that instead of modifying your magazine in any way, you publish a subsidiary

magazine in any way, yo to appear on the fitteenth of every month; this subsidiary to contain all the innovations suggested by your readers, also to be independent in every way, even to the subscription charges. I am of the opinion that a great percentage of your present day subscribers would wel-



seribers would week monthly environment more or less like the following: Instalments of; The Home Workshop Manual or any other similar manual; a good scientific novel; a scientific work of general interest; courses in, say one so, a "real" inventors' department; a sheet of coupons, to be used in conjunction with your advertisers, allowing your readers a rebate on standard prices and well, of course the more you can give us the better of the properties of the propertie

Glass Goblet, Not Ear Drum, Shattered by Singer

It has been said that Caruso would sing into a glass goblet, the tone which the goblet possessed and the goblet would fall to pieces. Dr. Abrams believed that he could change the conditions of diseased tissue by applying to the tissue a rate of vibration similar to that of the tissue affected. Recently Dr. Leslie A. Chambers and Prof. Newton Gains of Texas Christian University, perfected an apparatus that would kill eighty percent of all bacteria present in samples of milk. In putting different mixtures of potenized medicine into a glass goblet I have had the experience of having them fall to pieces on the table. The reason is probably because the native vibration of the mass, due to the constant movement of the atoms within it, produce an individual set of emanations that travel on their own plane. When a forced set of similar vibrations meet the mass vibrations there is an explosion.—C.E.M., Seattle, Wash.

Nudist Colonies Might Gain Another Good Member

As TO J.W.L.'s contention that the artificial production of diamonds will not prove of commercial value, we will not argue. One

commercial value, we thing that appears obvious, however, is that J.W.L. does not appreciate what science and scientific research have produced. Might I suggest that he go about his daily routine without using anything produced by science. Soon, I am sure, he will change



sure, he will change his mind and be glad to wear comfortable clothes, ride to work in a car, and sleep in a soft bed at night. And eat something properly cooked.—R.W.M., Harrisburg, Pa.

Magazine, Not Newspaper, Wanted by This Reader

I Have been a very ardent reader of your magazine since 1924 and this is the first suggestion I have to make. Let us have a few more pages devoted to radio circuits and diagrams. After reading "Our Readers Say," I have this answer to make to C.E.G. of S. Fernando, Argentina, regarding the parameter of the control of the

Pertinent Facts to Oust Fanciful Astronomy

I snotto like to take up a little space in reply to the letter of J.V.L. of Evansville, Ind. If for any reason the star A, which is one light year distant from the earth, were obliterated we would not know it until one year after the occurrence. The fact that it is one light year distant states that it takes light one year to reach us from the star. As a matter of the star of the star of the star of the star distant. Light does not travel instantaneously. Its velocity in air is 186.285 miles per second as determined by Michelson in 1924 at Mt, Wilson, California,

with an error of not more than ten miles per second. As to the absence of stars at the horizon proving the vacuum, that is all bunk. The greatly decreased number of stars at the horizon is due mainly to the fact that the clouds and dust in our atmos-



dust in our atmosphere obscure them. Looking at the horizon one looks through the thickest and denset part of our atmosphere and there are in-variably clouds and dust present. If one were to look at the sky in the late fail, one when the late shall, one that have the late fail, one the late shall, one that have been the late shall be horizon in the East and it will extend below the horizon at about the North and South points. Where then does the statement that "the absence of stars at the horizon serves to prove that space is a vacuum" come in? If JVL. would like to know a little smore than the late of the late

Ice to Water Question Brings This Answer

W.M.G., Port Washington, N. Y. asked about ice and water at zero, Centigrade. It requires eighty calories of heat to change one gram of ice at zero to one gram of water at zero C. So if you have one gram of water at 0° C. you must take away eighty calories of heat to change it to ice at 0° C. and vice versa. Since you add or subtract heat it is not perpetual motion. Can anyone tell me

what a photon is? It is something that has never been found in parts. It is always whole, Dr. R. A. Millikan says that it is proof that matter is building up in outer space. Now then what is it? I should also like to know where your arist found the five legged microbe he pictured. His pictures are all right, but I wish he would be accurate.—R.R.F., Noble, Pa.

Flying Chinamen Just Flapped Their Wings

THERE'S an old, old legend, or something, to the effect that centuries ago the Chinese flew on flapping, man-powered wings. The report doesn't say

report doesn't say they ever got very high or very far and it makes no mention of what happened to the flyers. Plenty, most likely. Now you tell us sea gulls are going to give men the secret of flight on personal wings. Oh, yeah? The condor is quite



a bird, with a wing spread enormous in proportion to its weight. Take a human bird and give him a wing spread in the same proportion and then figure out the muscular development necessary to run those wings and you'll get something. Why not talk sense once in a while and admit that man is a machine-using monkey and pittiful when robbed of all artificial means of attack and defense?—L.D.T., Larchmont, N, Y.

Our Knockers Give This Florida Reader a Pain

I AM a steady reader of Popular Science Monthies and I think there is no other magazine like it. I agree with W.T.C. of Muskogge, Okla, knockers give me a pain. I have all my copies of Popular Science in my wardrobe. The covers are wearing out time waiting for the next one to come and when it does come my family won't hear a word from me until I have read it from cover to cover- R.C.W., Jacksonville, Fla.

His Morning-Glories, Like Some People, Always Seek the Sun

I AM having trouble with my morningglories. If I were a scientist, as many of "Our Readers" are, I could tell what is wrong. I tried to make them climb

wrong. I tried to make them clim from the left side of the wire around to the right, and arranged them like that; but they unwound themselves immediately, so I tied one in that position, and it twisted to the tried one in that position, and it twisted to ut a new tendril,



and began to climb from the right side of the wire back around to the left. So I dug into my botanical knowledge, and reasoned that they were following a natural law of pointing to the sun. "Our Readers" must tell me if I am right,-J.C.B., Pocasset, Okla.

Even The Grecian Bend Yields to Old Man River's Curves

In a recent issue, you named the Nolin River as America's most crooked stream. This is not literally true. The Mississippi River should be given that designation if the distance traveled by water and land is to be used

as a gage. At New Madrid (Mo.) Bend, one travels forty-two miles around the bend. when from the head of the bend across the neck of land to Tiptonville is only two and three-fourth miles. Above and below Arkansas City, Ark., are other bends



equally large, though the neck of the bend is not so narrow. Lake Village, Ark., formerly at the head of a large bend on the Mississippi, is now some thirty miles inland, situated on a half moon shaped lake formed when the river cut through the neck of the bend during high water. There are several other bends in Louisiana that are very similar in proportions to those cited. At Great Bend, Kans., is another rival of the Nolan River. A series of bends on the upper Missouri River cause the traveler to take his hoat sixty-two miles around, but he can stand on a slight hill and look across to the foot of the bend only eight miles away.—C.G.W., Rockford, Ill.

Here's a New Way to Get Real Law Enforcement

I HAVE been a reader of POPULAR SCIENCE Monthly for several years but have taken no part in criticism or suggestion in regard to your articles for as a whole your magazine just suits me and I have been content to leave well enough alone, but I can't help making a comment on the article by Mr. Teale in a comment on the article by Mr. Teale in a prisons is timely. Let us have more articles, and give us more definite figures as to what this crime wave is actually costing each in-dividual. I am sure if we can get enough publicity on this subject the honest people will rise in revolt when they find out what it is costing them. Most of your readers seem to have sound minds and I think seed sown here would fall upon fertile ground. I know the average man, not connected with a law enforcement branch, does not realize what it means or what it is costing him or he would have been up in arms long ago.— J.W.C., Chillicothe, Ohio.

You Spray That Water to Run That Car

I AM writing you with reference to a problem that I have been wondering about for six months or more. The problem is this: Why can't motors be built similar to Diesel engines and made to run on water? My

theory is that instead of spraying fuel into the hot, highly compressed air in the cylinder, you inject a quantity of water. It seems to me this water would instantly change into live steam and create enough power to run the motor. Probably there's something wrong with this



idea. Otherwise someone would have tried it long ago.-V.E.I., Pasadena, Calif.

Oh. Feet and Feet and Feet at Least-Maube More

HERE's one to exercise your ingenuity on: A certain rectilinear field was of such proportions, that the length was to the breadth. as the diagonal was to the length. If the breadth was 100 feet, how many square feet did the field contain? This isn't really more than half as difficult as it looks.—C.A.P., Monrovia, Calif.

Government Will Analyze Fake Cure-Alls for You

Answering the letter from F.A.W., Miami, Fla. I work at a place to which the Government sends a circular about condemned articles that are supposed to cure all kinds of pains, aches, and sickness. If you will be kind enough to get a bottle of one of these fakes, you would not only help yourself but many others by just sending it to the following address where it will be analyzed and if it does not contain the said ingredients it will be taken off the market. Send the bottle to United States Department of Agriculture, Washington, D. C.—W.C.K., Hempstead, N. Y.

Jove's Thunderbolts Get a Ouite Modern Setting

Man made lightning leaped a thirty-foot gap, your splendid magazine tells us. Could have heen sixty, had there been room, you add. Why only sixty? Why not six hundred? Or six thousand? What's the limit to voltage?

Hasn't it occurred to anyone but me that here is a mighty wea-pon of war? A thousand yard lightning bolt could wipe out a regiment, a dozen regiments, or how many you got? Re-member the legend of Jove's thunderbolts



destroy distant enemy ships in the dim past of Greece's history? Maybe that wasn't all legend but merely the expiring flourish of a dying Atlantis civilization. I'll bet that neither you nor anyone else can prove I'm wrong.—M.J.H., Fleet-wood, N. Y.

Why Your Fish Would Weigh What It Weighs and When

Answering the problem of L.W.R., Monroe, Mich., concerning some poor fishes. A fish weighs less in water than out because water, being heavier than air, it displaces more of its weight in water. If the air or gas in the bladder didn't weigh anything, how do you suppose the fish could contract the darn thing to make himself heavier? The fish if not actually heavier, in weight, is heavier in comparison to its two sizes which increase and decrease with the expansion and contraction of the bladder. Now if the air or gas weighed nothing, by contracting it he'd have a space full of nothing that would weigh something, or some such thing. The fish that you killed and the fish that you let suffocate would weigh the same in open air. But if they were weighed in a vacuum, the fish you killed would weigh the more, as it would still have air in it, while the one that you suffocated would have gradually lost all air.—T.P.S., New York, N. Y.

Anthropology Is His Long Suit and He Likes Fast Cars, Too

As a contribution to your "Our Readers Say" pages, I should like to say that I like your articles on archaeology and anthropology, etc., the best, and wish you would have more of them and less on radio and insignificant inventions. I like to read about racing cars and fast commercial cars, too, and enjoy the articles you have on these subjects. It's a good magazine though, after all .- J.R.T., Tustin, Calif.

Somebody Surely Is Bugs -And It Mau Be We

Your article on electric hotbeds gave me an idea—honest. As it's too good to keep to myself, here it is: Get those laboratory fellows to figure out a way of transforming radio waves into heat energy. Then big central waves into heat energy. stations could broad-

cast heat lightning to the farmers and garden truck chaps with a resulting enormous increase in output. Think of the starving people who could be fed. Think of the low prices that would still vield a profit. Think of the scramble back



to the farm lands.
Well, just think. Who's bugs now?-P.E.T., Hartford, Conn.

Gas, Not Dunamite, Is Blamed for Explosion

REFERRING to your article in a recent issue on "How Bomb Sleuths Trap Pineapple Murderers," I would say that I believe your photograph of the wrecked automobile is at variance with the description given. I believe this explosion was not caused by dynamite, but that it was an explosion of a gas tank As you probably know, dynamite is a "high explosive." Its action is so rapid that the force is expended equally in all directions. If you lay a stick of dynamite on top of a rock, with no cover, and explode it there, the rock is shattered. Hang it on any side of the rock, but of course against the rock, and the same thing occurs when it explodesthe rock is shattered. A mixture of gasoline vapor or fumes mixed with from 2% to 5% of air makes an explosive only slightly less powerful than dynamite. It has the explosive effect of black powder as the force of the explosion is expended in the direction of least resistance. The force of the explosion that wrecked the car you showed was expended upward, and this gives it the earmarks of a gas tank explosion. One thing that is not generally known is that a charge of dynamite powerful enough to throw a 150 pound man upward through the top of an automobile would, literally, tear him into shreds. It is hard to explain to the general public that these things can happen. The very name dynamite has a fearsome effect on most persons, and juries would rather say that an explosion such as depicted was the effect of dynamite than to let on that it could be caused by gasoline .- C.G.W., Rockford, Ill.

Wouldn't We Look Sweet as a "Fashion Magazine"?

I AGREE with F.A.S., Darien, Wisc., that you probably are addle-headed by now. What next? A woman's page in a mechanical magazine! I suggest

you leave POPULAR SCIENCE MONTHLY as it is-except you might add a little more chemistry. Also I should like to sug-gest to F.A.S., that she get some fashion magazines along with a couple of medical iournals. Let's have more experiments.



more experiments.

Some one come on
with the solution that is used to treat gas
mantles. I wish to experiment some with this.-J.H.T., Oklahoma City, Okla.

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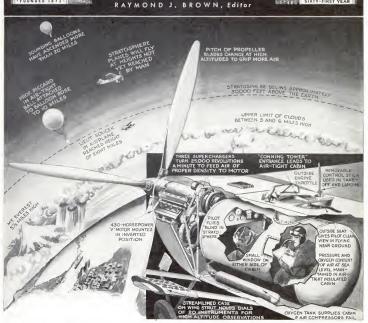
MONTHLY

October 1932

Vol. 121, No. 4



SIXTY-FIRST YEAR



High-Flying Planes Race SUN across Atlantic

By EDWIN TEALE

ARRYING within its fuselage an air-tight cabin shaped like a metal capsule, a silver-white monoplane soared into the air near Paris, France, a few the Farman plant, it is the latest entrant in an international race to conquer the stratosphere—the thin air ten miles above the surface of the earth.

Shortly before that, workmen at the Junkers' factory, Dessau, Germany, had completed a strange machine with a slender body and an enormous seventeen-foot propeller, also designed to fly in the stratosphere. Its preliminary, low-altitude tests completed, it is now poised waiting perfect whether for its first dash to the upper levels of the sky.

A third machine, a huge monoplane with wings of variable hard designed by the French engineer. M. Guerchais, is receiving its finishing touches as this is written. This craft, its inventor predicts, will be able to climb to an altitude of ten miles in forty minutes.

Within the next few weeks, one or more of these planes may blaze a trail into the rarefied air above the 50,000-foot level. In this region of bitter cold and steady winds, aero-



winds" for planes heading in any direction. Miles above the highest clouds, the "thinmachine's open hatch air ships" will race through clear air, aided by favoring winds and uniform weather. Guiding his machine from an air-tight cabin, the pilot will navigate by stars that shine day and night,

in a blue-black sky. We see the stars disappear and the sky turn light blue in daytime because we look upward through a haze of reflected sunlight. In the stratosphere, above this haze, the sky is always black, the stars shine continually, and the sun gives off the harsh glare of a searchlight.

Favoring winds and the thinness of the air will make possible tremendous speeds. Engineers predict the Farman plane may rush beneath the jet black sky at 400 miles an hour; favoring winds may add another 100 miles. Such speeds would bring Paris within eight hours of New York and make possible a round trip between America and Europe in less than twentyfour hours. At the latitude of Paris, a plane going 500 miles an hour could circle the world in a single day.

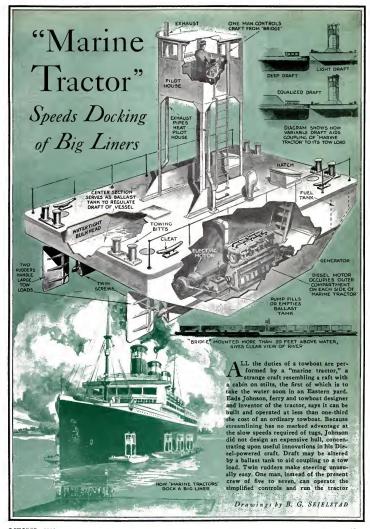
Because this is true, the first pilot to head westward from the French capital at 500 miles an hour literally will race with the sun. Because he will be going fast enough to circle the earth in twenty-four hours, he will remain in a fixed position in relation to the sun while the earth is spinning beneath him. If the Farman plane heads west at that pace, its pilot, Lucien Coupet, will be the first man since Joshua to see the sun stand still in the sky!

However, the thinness of the upper air which makes such tremendous speeds possible also accounts for some of the greatest difficulties the designers of high-flying planes had to overcome. Stratosphere ships will fly at a height where the pressure is less than one-eighth that of sea level and where no breathing thing can exist because of insufficient oxygen,

When spectators crowded around the Junkers and Farman planes on their first appearance, the feature that interested them most was the air-tight metal cabin designed to protect the pilot against these dangers.

On the Farman, the cabin is a duralumin cylinder seven feet long and three feet in diameter, shaped like a capsule. You enter from the top of the fuselage through a round "conning tower" and descend into what seems to be a miniature submarine. Two seats, one in front of the other, are fitted with dual controls. Electric bulbs light the interior, for the only openings that permit sunlight to enter, or the pilots to look out, are small portholes, one on either side of the cabin. Just outside the left porthole, a streamlined case on a wing strut holds the dials of twenty instruments for making observations during trips to the stratosphere.

At the start of a flight, one pilot crawls forward and takes his place in the leading seat. The other, perched high on the back of the fuselage where he has a clear view in all directions, guides the plane into the air, using a small demountable control stick and auxiliary rudder pedals. At ten or fifteen thousand feet, he signals the other pilot in the "blind" cabin below who takes control, flying by instruments. Then the "take-off" pilot, who also lands the plane, clambers down, (Continued on page 96)



OCTOBER, 1932

ELECTRIC ORGAN PRODUCES NEW TONES



MUSICAL tones different in timbre from those of any other instrument come from a new electric organ. The inventor, Ivan I. Eremeeff, Russian engineer living in Philadelphia, Pa., calls it a "gnome instrument." Outwardly it consists of a keyboard on a pedestal, with im-movable keys of stainless metal. The performer sits upon a stool covered with iapanned metal and plays the instrument by touching his fingers to the keys. This contact forms a circuit between the electrically-wired stool and keys. and causes the tones to be sounded. Within the instrument are whirling disks, one for each tone, operated by an electric motor in the base. When the performer touches any key, the corresponding disk magnetically actuates a radiolike circuit that amplifies the tone.



BLADE ON TINY NEW SAW EXTENDS FIVE INCHES

UNUSUAL in design is a tiny saw that can be used for cutting wood and metal in places where it is impossible to employ a larger saw. Detachable blades, clamped in the groove of a rustproof steel holder, can be adjusted to extend five inches beyond the end of the holder. The little saw is designed for keyhole and conduit work.



GOLD SPRAYED ON WOOD

EVENING gowns of shimmering platinum, and wood and paper articles coated with gold, are forecast by recent experiments at the California Institute of Technology, where the apparatus show the properties of the properties of the properties of the properties of the metal and the object to be coated are placed in a vacuum chamber and the first is heated electrically, a "mist" of metal is sprayed on the object.

ODD ALARM AT GAS STATION

So that he could work at the back of his shop and still serve customers stopping for gas, an ingenious garage man constructed the alarm device, shown in the photograph at the right. from an old trolley gong, a hammer, a short length of chain, and old trolley ties. When a motorist drives into the position shown by the car in the photo, the lever in the roadway is depressed, actuating the gong and summoning the garage man. As soon as the car moves on the gong stops.



When a car is driven across the lever in front of this gas station, the alarm, automatically sounded, calls the salesman

RAILROAD USES TOYS TO FIND LOSS DUE TO WIND

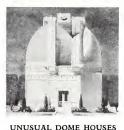
Toy-sized trains were recently taken to a wind tunnel at Teddington, England, to help experimenters learn how to reduce the wind resistance and power consumption of engines and cars. Strung upon a steel bar connected to balances outside the tunnel, a model six-coach train was thus exposed at an angle to the roaring gale of an airplane propeller while the engineers measured the forces striking it from front and side. Models of individual locomotives were also hung on wires attached to balances, for tests at wind speeds as high as seventy miles an hour. The picture at right shows an experimenter setting up the model of the train in front of the powerful blast from the whirling airplane propeller. The force of the air current is carefully gaged to ensure accuracy of the data.



When the driver of this speedboat fell overboard as he made a sharp turn, the craft dashed ahead, atruck a yacht, and drove its aharp prow completely through the hull

SPEEDBOAT PROW PIERCES YACHT

At a Chicago regatta, not long ago, a speedboat hurled its prow at forty-five miles an hour against a large yach with the result pictured above. The freak accident occurred when Fred Harvey, driver of the speedboat, fell overboard and the boat roared on. No one was burt.



BIG NEW TELESCOPE

will house a photographic telescope now being built for the Naval Observatory at Washington, D. C. Light from nearby lamps

will be kept from the telescope by the col-

A MODERNISTIC dome of welded steel

Shaped like a seat and padded with sponge rubber, this new auto bumper is lifting a pedestrian out of danger

is lifting a pedestrian out of danger

CAFETERIA ON FAST TRAIN

A CAFETERIA for Pullman passengers was installed recently by an English railway. While the train rushed along the passengers filled their trays in the cafeteria compartment of the Pullman. The success of the cafeteria car is expected to lead to the adoption of the idea on all trains of the system. Photo at right shows car with countergirl and barmaid.



lapsible, tubular shade visible at the top.



German Mountain Guards practice their life-saving stunts in the Alps

CAR'S SEAT-LIKE BUMPER SAVES PEDESTRIAN'S LIFE

WHEN a new safety bumper, invented by an Engishman, is attached to the front of a car, it is said to be virtually impossible for a motorist to run over a pedestrian. The bumper, shaped like a seat, is padded with sponge rubber. If a person is struck, he is knocked into a sitting position and carried along on the bumper. The inventor, A. J. Grafham of London, permitted himself to be run down by a car equipped with his device and escaped without injury.



VICTIMS IN ALPS SAVED BY CABLE

How in jured mountain climbers are brought back safely to the hospital was demonstrated recently in thrilling practice maneuvers by the German Mountain Guard. Formed twelve years ago to patrol the German Alps and rescue climbers in distress, this organization saves as many as 400 lives in a single year. Often it is necessary to fashion a cable "railway" to swing an injured climber across chasms by an aerial route, and the practice exercises train rookie members of the guard in this difficult work.



cently performed by Westinghouse research engineers at East Pittsburgh, Pa. To test the rate at which different metals wear away, the experts screwed two quarter-inch plugs into the rim of a

wheel that whirled them 20,000 times a minute, or more than 300 times a second, through two jets of water the size of a lead pencil. In less than three minutes, the water had eroded plugs of stainless iron and nickelsteel halfway through. Iron nitride, almost diamond-hard, could withstand this "ordeal by water" for only fifteen to twenty minutes before the jets cut half through the plug. The test revealed the wearing qualities of turbine blades and of airplane propellers whirling at tremendous speeds in rain. As a result of these experiments efforts will be made to develop an alloy capable of withstanding for a longer time the destructive action of the water through which it may be driven at high speed,



Steel plugs set in rim of wheel are whirled through jets of water at 20,000 revolutions per minute. At right, view of plugs cut nearly in two by the water

HOME SPRINKLER SOUNDS FIRE ALARM

A MIMATURE sprinkler system to protect private dwellings from fire has just been perfected and placed on the market. Though it resembles the larger outfits that guard office and industrial buildings, each part has been especially adapted for domestic use. The new apparatus is installed in the cellar of a home, where statistics show a large percentage of fires start. It is connected to the household water supply. When flames raise the air temperature to 135 degrees, the nearest sprinkler head open and pours water on the blaze. At the same time, it rings an electric alarm bell.

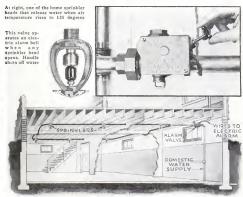
SHOVEL, PICK AND HOE COMBINED IN ONE TOOL

SHOVEL, pick and hoe are combined in a new tool designed by a San Francisco inventor and shown in the photograph. The implement may be adjusted for the desired use and locked securely in place within five seconds. According to the inventor, it should prove especially useful to gardeners.



SAFETY WHEEL FOR CAR ENDS BLOWOUT WRECKS

DELIBERATELY wrecking a tire by driving over large bolts and nuts, a Pittsburgh, Pa, inventor recently demonstrated his new "safety wheel" to prevent a driver from losing control after a blowout. The car's weight drops on a metal disk faced with solid rubber, attached to the wheel.



Drawing showing how the miniature sprinkler system for private homes is installed

Asbestos Shield Protects Firemen

UMBRELLAS of asbestos are the latest German aid to fire-fighting. Every member of a fire brigade in a provincial city of Germany was equipped recently with one of these

new implements. When open, it shields him from the most intense heat so that he can play his hose on the blaze at close range. An aperture is provided in the umbrella for this purpose, For carrying and



Below, asbestos umbrella with opening for hose used to protect firemen near blaze. At left, drawing shows how umbrella is used in getting close to burning structure. At far left, umbrella folded for carrying

storage, the device is quickly folded. The idea for this invention is said to have been taken from asbestos screens employed by sprayers of liquid fire in the world war.

RAILWAY INSTALLS TWO-STORY CARS





MACHINE TEACHES FAST WORK AT TYPEWRITER

To SPUR typewriting students to greater speed, a Portland, Ore, high school instructor devised the practice machine shown above. A series of words passes continuously across a window at the front of the cabinet. The student is required to copy them. A second's delay and the words are past the window and permanently lost to view. Turning a knob slows down the procession of words, and the dial may be set and locked by the instructor at any speed from ten to 120 words per minute.

LETTERS MARK CEMENT

LETTERS of aluminum, with finger-holds on the back, are now used to print signs in comment. Pressed down into the wet cement, they form indented words. Used with a straight edge, the aluminum stamps produce clear-cut lettering with a minimum of

with a minimum of effort and of time, according to the manufacturer.



MOVE FREIGHT IN TRAILERS

A CURIOUS train of trailers, pulled by a three-ton truck "engine," passed recent tests in England, Rolling along on twenty-four balloon tires, the three trailers, each carrying fifteen tons of freight, followed the pulling truck in a thrilling demonstration. The train is designed for hauling freight in the tropies and Far East.

OCTOBER, 1932

Help Yourself to a HOME

Uncle Sam Still Has Millions of Acres of Land Waiting for Settlers and Thousands Are Now Filing on Western Farms

By ANDREW R. BOONE

Eslie Wynn, once a jeweler, is now a confirmed homesteader living on his 160-acre farm in southern California and busy raising alfalfa

IX shallow water with reasonably suitable soil and add \$250 in small installments. There you formula for the acquirement of a home on 160 acres of some 200,000,000 acres of Government land yet available to the American public.

Today thousands of people are turn-

Today thousands of people are turning to the public lands, establishing the homes they long have wanted and finding in the wide open spaces of southwestern deserts and northwestern prairies and in western mountains the freedom of which they dream.

Before the current economic unpleasantness the general land office at Wastington received some fifty inquiries a day from persons interested in getting a piece of Uncle Sam's land. Now as many as a thousand inquiries are received in a sin-

gle day.

Eslie Wynn, who gave me his formula for successful homesteading, no longer is interested in the struggle for land. He has his; has increased its value from nothing to at least \$40 an acre, for recently he sold a twenty-acre piece at that rate. And now he lives comfortably in his \$200 stone home, oversees a helper who raises his alfalfa and vegetables and, as a side-line, conducts a small store and gasoline pump thirty-two miles from the nearest town in the heart of Borego valley in southern California.

Wynn's story is typical. When he first went onto the desert a few years ago, after having served two decades behind a jeweler's counter, his automobile could not carry him to the plot he had picked out on a map. He paid a rancher \$12 for the use of four burros to get his belongings to the center of the valley. Wynn slid off one of the little "desert

Wynn slid off one of the little "desert canaries" at the end of a hard day's ride and where he planted his feet he decided to stay. For a year he lived in a tent A discarded auto engine runs this pump and raises water that is stored in a reservoir until the crops are watered

cabin, meantime drilling for water and fencing his plot. When I visited Borego valley recently, to learn for the readers of Popular SCIENCE MONTHLY from the homesteaders themselves how they have accepted the Government's offer of free homes, I found him swinging his feet from the counter of his tiny store while across the sandy road an automobile engine, bought from a junk dealer for \$5, was turning a \$15 pump that lifted water from two wells into a shallow reservoir to water his alfalfa.

I had driven my car thirty-two miles through

a narrow mountain canyon after leaving the paved highway. Roads, little more than hard-packed trails, make it possible today for many homesteaders to take up land where a few years ago they could not easily reach a chosen plot.

I met one young fellow with a broken-

Where Government Land Still Waits for the Homesteader

•			
California	16,046,000	acres	
Nevada	51,399,000	66	
Utah	25,157,000	"	

Small Amounts in:

Idaho, Oregon, Washington, Colorado, Montana, Arizona, Arkansas, Nebraska, Florida, New Mexico, Minnesota, South and North Dakota, Kansas

Filing Fee:

160	acres	\$16	to	\$22	
320	44	\$22	to	\$34	
640	**	\$34	to	\$58	

down truck halted alongside the narrow trail. After I had offered such help as aly within my power. I inquired about his work. During the day, he told me, he drives the truck for a near-by ranch and each evening he turns the nose of his fliver south to his homestead, seven miles



distant. In the evening, on Sundays, and at odd times when work is slack, he builds fences, clears land, and works his crops. A couple of months' work gets food for the rest of the year. Meantime he's perfecting his patent and in another year will own 160 acres, with water supplied from a twenty-five-foot well.

His is one of the 63,000 homesteads

now being taken up.

Large acreage is still available today, but in Texas, Georgia, North and South Carolina, Tennessee, Kentucky, Missouri, Iowa, Illinois, Indiana, Ohio, the Virginias, Maryland, New Jersey, Pennsylvania, New York, Connecticut, Rhode Island, Massachusetts, Vermont, New Hampshire, and Maine none can be had. Small amounts can be had in Michigan, Wisconsin, Kansas, Oklahoma, Mississippi, Alabama, and Louisiana.

All but one million acres of the public lands available for homesteading lie in the eleven western states. But how do you get it?

In the first place, there are three general types of homesteads: 160 acres for ordinary farming with water, 320 acres for dry farming, and 640 acres for stock

raising. For the first of these you pay a filing fee ranging between \$16 and \$22, depending on the value Uncle Sam places on the land; a fee of \$22 to \$34 chables you to move in on the dry farming plot, while \$34 to \$58 secures the stock raising homestead.

When you apply, the land agent in your district will tell you whether the piece you want has been withdrawn for forest or some other purpose. If it has been withdrawn he still will forward your application to the General Landciton to the General Landciton, at Washington, since the reason for withdrawal may have disappeared and you still may get the land.

The Government is generous with homesteaders, once they have been permitted to file an application, but it is a strict disciplinarian. You can't get a piece if the Secretary Typical homesteader's desert dwelling house. The front room is used as a store

of the Interior is convinced you can't make a living on it; yet, if you are trying honestly to improve the homestead, the department will go great lengths to keep you there.

If you fought in any war Uncle Sam will waive some of the residence requirements, making allowance for the months you spent in uniform. Not only do exsoldiers and the widows of veterans who died in service have preference in claiming homesteads, but they need live on the land during only part of the term. Generally speaking, the veteran must continue his residence and cultivation only for such period as will, when added to the exceedider with nineteen months of service may fulfill the residence requirements in seven months.

Most of the 63,000 homesteaders now perfecting their titles took up the type of homestead that requires them to live on the land while improving it. Frank B. Osborne can tell you how to accept the Government's offer of free land, for he and his wife are just now ready to make final proof that they have lived twenty-can be sufficiently that they have made all they have made all the improvements required, besides raising watermelons, to-matees, and corn.

Three and a half years ago Osborne decided he was (Continued on page 97)



While waiting for irrigated desert land to grow crops, many settlers raise flocks of turkeys for the market

Latest Developments in

AVIATION









BALLOON LIFTS GLIDER. Attached to a hot air balloon, this glider was carried afort for a test flight at Aurora, Ill. Cutting loose from the balloon, the glider flew at a good rate of speed for four minutes, driven only by three exploding rockets



HOOKING TO BIG AIRSHIP. This unusual picture shows a high speed plane grabbing the trapezelike contrap-tion that lifts it aboard the Akron. In the background can be seen the wing of a second airplane that also hooked on



Recent tests proved that even fragile cargo can be landed from an airplane with a special para-chute. Picture shows H. E. La Fayette, inventor, dropping an airplane propeller to test the cargo parachute. A small pilot parachute opens big one



During a recent aerial demonstration at Rome, Italy, over 400 air-planes and many balloons took part in the unusual stunts. Photo at right shows the human fly race in which military aviators, tied to balloons, leaped lofty obstacles set in their way





Robot Hero Fire Panic

UST as a cool-headed man may halt a panic when fire starts in a crowded theater, by ordering the orchestra to play and the audience to file out calmly, so a new "automatic fire hero" plays the same role mechanically. Unlike the human hero, whose presence cannot always be counted upon, this amazing electrical system is constantly ready.

When a sensitive electric wire strung through the building delects fire, it sets the system into action through a central control panel. Green arrows, lighting up in the halls, point the way to exits. Meanwhile a phonograph starts. Its amplified tones issue from loudspeakers scattered throughout the building.

Records are suited to the type of build-



Exterior of a typical control panel for the automatic fire hero system. Switches behind it start loudspeakers while lights in front give location of fire





Close-up view of apecial fire-detecting wire which is atrung behind moldinga. Heat melts fusible core which expands, hurns away the paraffined insulation, and sate off the alarm. At left, wire, like that seen above, detected the fire caused by hot flations and sounded the alarm so promptly that no more damage than picture ahows was done by blaze

Above, a phonograph playing band music and sounding fire warning. Installed
within fireproof walls, its
amplified tones reach every
part of the building through
loudspeakers, like the one
shown at left. Note lighted
arrow pointing way to exit

ing—theater, school, or lecture hall. Pupils in a schoolroom hear, first, a flare of trumpets, and then a distant siren, followed by a calm voice saying, "There is a fire-mediate danger," by the compared of the control of the contr

don't rush. Follow the green arrows." A brass band strikes up. Through the music are heard approaching sirens.

Everything in the record is planned for its psychological effect. The music is selected for its marching rhythm. The siren

is used to accustom the children to it in drills so that they will not be frightened by the real thing. Meanwhile, the fire department is notified automatically by the electric system.

Meanwhile, the fire department is notified automatically by the electric system. Arriving firemen find red arrows in the hall pointing toward the blaze.

Numerous installations have been made of the fire-detecting wire. With the addition of the sound apparatus, developed by Western Electric engineers, a real mechanical hero is provided that may be depended upon to prevent a panic.



BELGIUM'S TANK DESTROYER TOWS GUN ON WHEELS

Newest weapon against the formidable tank of army warfare is the "tank destroyer," of which the first recently went into service for the Belgian Army. This motorized unit includes a powerful field gun, mounted on a four-wheeled towing carriage, and a speedy tractor of endlesstread type to whirl it into action. Army experts believe that a fleet of these swift "destroyers" could set up their mobile artillery in time to repel a surprise advance of enemy tanks.

HYDRANT BREAKS EASILY BUT PREVENTS FLOOD



VIBRATING TABS HELP MUSICIAN'S FINGERS

AN ELECTRIC finger exerciser for musicians is the invention of a Portland, Ore, music teacher. When the fingers of either hand are laid upon four metal tabs and the current turned on, a motor vibrates the tabs and exercises the finger muscles. Players of any keyboard instrument are benefited by the treatment, according to the inventor. Their fingers become so supple that difficult musical passages are easy to perform.

When the driver of the trusk at right struck the breakable trusk at right struck the breakable trusk as to the replaceable breaking trusk as to the replaceable breaking radius prevented damaging flood of water breaking trusk as the replaceable breaking trusk as the replaceable breaking radius prevented damaging flood of water breaking radius provided the replaceable by the replaceable by the replaceable breaking radius as the replaceable breaking radius as the replaceable by the results of the replaceable breaking radius and replaceable breaking radius as the replaceabl

At first glance the chief virtue of a new style of fire hydrant might seem a defect—for it is especially designed to break! But the designers have a good reason for their seeming folly. When an ordinary hydrant is smashed by a skidding truck or pleasure car, the collision may entail extensive repairs both to the hydrant and the pavement surrounding it. The new hydrant has a threaded "breaking ring" above ground, connecting the top with the below-ground section, which snaps off when

OF HYDRANT

struck a heavy blow. A new ring may be installed in a few minutes. It is even unnecessary to shut off the water pressure, since a self-closing valve in the hydrant inlet prevents flooding.

HANDY PENCIL HOLDS IODINE

First aid for cuts and wounds is provided by an antiseptic pencil that may be carried in a pocket, handbag, or camping kit. Resembling a fountain pen, it holds a hundred drops of iodine. When the cap is removed and the antiseptic pencil is tapped lightly, a drop of antiseptic falls upon the wound, as shown in the photograph at right. The nozzle is removable for refilling.



CONCRETE ROAD LINES REPLACE PAINT STRIP

White concrete center lines are being built into highways in New Jersey in place of painted strips. The six-inch ribbons of concrete, running down the center of the roads, will provide permanent markings—an improvement over painted lines which must be renewed frequently due to ravages of weather and traffic. Thus the concrete marking will prove economical.

POPULAR SCIENCE MONTHLY



Taxi on Pontoons Takes Passengers for Fast Joy Ride

By fitting improvised pontoons to a discarded automobile, Isadore Cholfin, of Somerville, Mass., has created what he calls his "salt water taxi." A series of underwater propellers give the craft a speed of ten miles an hour through the smooth waters of the Charles River. The driver handles the controls in the same way as on dry land. Though one of the many signs scrawled on the side warns, "No swim? No ride!", Cholfin has no difficulty in finding passengers.

ROUND JAW GRIPS PIPE

A Los Angeles, Calif., inventor has on an ingenious pipe wrench. To make it grasp a pipe, the handle is twirled, advancing the circular inner jaw. The piv-oted outer jaw has sufficient play to bite into the pipe when the wrench is turned. A thumb lever working against a spring releases the wrench from the pipe as shown in the photo.



CLAWS ON GARDEN GLOVES SAVE HANDS

To MAKE the task of weeding the garden less trying upon the hands, gloves with claws have made their appearance on the market. The claws are mounted one on each fingertip and riveted to the fabric of the glove. Their pointed tips speed up the work of removing rootlets and weeds from the flower bed or vegetable plot. The gloves appeal especially to women, since their use averts dirty fingers and spoiled manicures.



Steel claws are fastened securely to the fingertips of these garden gloves to speed the work and protect gardener's hands

BIG "MYSTERY BULLET" CAR HAS COMFORTS OF HOME



"Mystery bullet" car, streamlined for speed, a home on wheels in which are refrigerator, radio, bath, and sleeping accommodations for four persons, was built by California mechanic

A STREAMLINED house on wheels, called by its builder the "mystery bullet" car, has been constructed for cross-country jaunts by a Santa Monica, Calif., garage mechanic. Its interior contains bath facilities, davenport and lounge chairs, radio, electric refrigeration, a phonograph, regreation, a phonograph. There are sleeping accommodations for four persons. The body is twenty-four feet long, six feet wide, and has a maximum height from floor to ceiling of sixty-seven inches.

How Jungle Near Our

Giant hippo shows the keeper his teeth as a preliminary to some needed dental work

By IOHN E. LODGE

WENTY-FIVE million people visit American zoos every year. Scattered from coast to coast, more than 130 zoological parks contain thousands of rare animals col-lected from all parts of the world.

How are these animals kept in good health? How are they treated when they get sick? What do they eat? How are the climates to which they are used repro-duced? In fact, what goes on behind the

scenes at a big zoo?

Those are frequent questions in the minds of visitors who see the animals on parade. To answer these queries and a host of others, I recently spent several days at Bronx Park, New York City, the zoo that holds more different species of wild life than any other on earth. Here, I learned what takes place when the gates are closed to the public, the way keepers care for rare specimens, how food is brought from far parts of the globe, and what scientific methods are being used to keep the wild creatures in captivity well and happy.

At the new reptile house recently opened at Washington, D. C., an elaborate humidifying, ventilating, and heating system has been installed. Thermostatically-controlled electric heaters at the back of every glassfronted cage keep the snakes at the temperature that best suits them. This ranges from eighty degrees Fahrenheit for the diamond-back rattlers and cobras to seventy degrees for the bull snakes and the spreading adder. Glass roofs permit the sunlight to stream into the cages and when the sky is cloudy, ultra-violet lamps snap on, filling them with synthetic sunshine.

A major problem in every zoo is supplying the animals, birds, and reptiles with sufficient sunlight. It is almost as important as proper diet. At Bronx Park, a fiftyfoot "sunshine island," circled by a water-filled moat and a concrete wall, has just been added to the equipment. In this sola-

Nubian giraffes, great hay eaters, need constant attention to keep them well. When "off their well. When "off their feed" they enjoy Bermuda onions. At the left, giant anteater that, in captivity, gets no ants but is fed milk, eggs, and beef that has been shredded

rium, more than 150 nonpoisonous reptiles will bask under the open sky during summer months.

In winter, four big ultra-violet lamps flood the jungle cages in the monkey house with artificial sunshine; 500-watt bulbs supply light and heat for the tropical lizards, and infra-red-ray lamps warm particularly sensitive birds and mammals,

Providing the right food for all the animals in a zoological garden is in itself a tremendous task, Tidbits from all over the world-ant eggs from the Black Forest of Germany, gopher snakes from the prairies of Texas, dried flies from the shores of Africa's Lake Victoria Nyanza are part of the bill of fare. In fact, feeding the 3,000 birds, animals, and reptiles at the Bronx Zoo requires 124 different kinds of food.

The most expensive boarder there is "Alice," the Indian elephant. Her daily schedule calls for 150 pounds of hav, fifteen loaves of rve bread, and a pail of bran mash mixed with oats. Three times a week, in addition, there is a bushel of sliced carrots, beets, and potatoes.

"Peter the Great," her next door neighbor, ranks second. The meals of this 4,500pound Nile hippopotamus include ninety pounds of hay, six loaves of rye bread, and a pail of mash each day, with a bushel of vegetables thrown in on Tuesdays, Thursdays, and Saturdays.

In the big storage barns at the park, timothy, clover, and alfalfa hay are packed in the hundred-ton lofts to meet the tastes of all the guests. Alice, the elephant, and Peter, the hippo, eat timothy but turn up their noses at clover. "Mogul," the great one-horned Indian rhinoceros, won't touch timothy but eats sixty pounds of clover a day. The antelopes like a little molasses mixed with their alfalfa. The tapir and the

Beasts Live Big Cities





Polar bear diving into ice cold pool to escape first warm day

pygmy hippos favor straight clover, as does "Jack," the fifteen-foot Nubian giraffe, which eats twenty pounds a day from a manger bolted to the side of his stall ten feet from the ground.

At the Philadelphia, Pa., zoo recently, the \$6,000 baby gorilla, "Bamboo," was provided with a special trained nurse who watched over his welfare and supervised his feeding. His meals cost about seventy-five cents a day and include two quarts for milk mixed with one raw eag, a few slices of bread and honey, xwieback, five bananas, an orange, prunes, grapes, and half a head of lettuce.

Feeding sea lions is a snap. Six times a

Chimpanzee, upper left, has a cold and, shut in amall compartment, is breathing a strong vapor from pine and boiling water. Above, tiger opens his mouth to show his tonsils

week, they gulp down about twelve pounds of butterfish, and their diet never varies. The meal ticket for the five sea lions at the Bronx Park is \$1,-500 a year, representing more than 28,000 pounds of butterfish.

No one-course meals, however, will satisfy the inmates of the monkey house. They crave variety, and their menu is changed from day to day. Here is a typical week: Monday, bananas, boiled potatoes, apples. Tuesday, carrots, lettuce,

warm day

Julis Tuesday, caros, letture,
hanas Tuesday, tende, tendesday, boiled rice, dates, raisins. Thursday, oranges, boiled potatoes, bananas, Friday, lettuce, carrots, bananas, Saturday, apples, bananas, oranges, boiled potatoes. Sunday, a few pieces of banana. The delicate South American monkeys have bone meal and codliver oil sprinkled over their food. Each evening, the big apes drink five or six cups full of eggnog before going to bed.

While zoo officials thus take utmost care to regulate the diet of their charges scientifically, the public has a different idea. Visitors try to feed the animals a weird array of tidbits from cigar butts and lollypops to golf balls and rubber dolls. Not long ago, a cassowary, an ostrichlike bird from the Malay Archipelago, died suddenly at one American park. A post-mortem examination revealed it had swallowed a wooden spool, a rubber nipple, a small doll, seven metal pop-bottle caps, a ball, and a piece of stone an inch and a half across. It had managed these all right. But when a woman fed it a facepowder compact, that was too much. At Cincinnait, Ohio, a 86,000 hippopota-

At Uncinnati, Ohio, a \$6,000 hippopotamus recently choked on an indoor baseball and died. One of the paradoxes among animals is the fact that the hippo has a relatively small throat attached to its cavernous mouth.

Only the other day, a keeper at the New York Zoo found one of the pygmy hippos apparently frothing at the mouth. Someone had fed it a big tube of tooth-paste! The polar bear cubs once ate two dill pickles and another time tried to swallow a piece of auto tire someone shoved between the bars as a special delicacy. "Peter Boy," the red-muzaled drill, nearly died a few days ago from eating a bot-dog; and five handkerchiefs, snapped up under the impression they were butter-fish, made one sea lion a very sick animal two summers ago.

As many as 80,000 people visit the largest zoological parks on a single Sunday. Three million passed by the cages at New York last year. If nouly a small percentage of the visitors feed the animals peanuts or popcorn. trouble ensues. Incidently, the keepers tell me, popcorn is worse than peanuts. When an animal fills up on popcorn and then (Continued on page 104)

X-RAY HELPS DOGS HEAR

WILL X-ray treatment improve the hearing of deaf persons? At the University of Illinois, experimenters have found that moderate, repeated exposure beneath an X-ray machine will double and even triple the hearing ability of dogs. Sounds for the before-and-after tests, were produced by a radio-like hookup. The dogs, standing near a loudspeaker, were trained to raise the right forepaw on hearing the sounds.

To teach each dog this sign language, it was placed in an especially designed rack with its left forefoot strapped and its right one in contact with an electric terminal. The trainer would sound a tuning fork, and a few sec-onds later apply a mild electric shock to the animal's right foot. The dog soon learned to raise its foot. In another training me-

thod, a stream of wa-

ter, squirted upon the

dog's nose, replaced the electric shock.



A tiny squirt of water on the nose of this dog taught it to raise its right foot when it heard a sound. Thus it was trained for "hearing" tests during X-ray treatment

At left, operator who can send either a sound or electric shock to dog in training. Electric shock was also used to teach dog to raise foot and indicate he heard noise

AIR BLOWER BUILT INTO BANK VAULT



New bank vault ventilator, set up for demonstration, shows how an imprisoned employe could start it from the inside and thus escape

BANK employes need not fear accidental imprisonment and suffocation in a vault. when it is equipped with a new ventilator designed for such an emergency. Turning a switch lever from the inside opens the outer air ports and starts a motor blower, drawing in fresh air through the nickel-alloy cylinder in the vault wall. To talk to his rescuers, a prisoner may stop the blower and speak through the tube.



NEW SWIVEL PLUG WON'T TWIST ELECTRIC CORD

INSERTED in any wall outlet, a new swiveling "intermediate plug" is said to eliminate twisted appliance cords and the possibility of short circuits. Since it automatically lines itself up with the cord plug, it is especially useful in corners.

THEATER CONTINUES WARMING UP LONG AFTER SUN SETS



IF YOU go to an evening movie after a sultry day, and the theater seems just to have reached its hottest, don't doubt your senses. Probably you are right, ac-cording to experts of the American Socity of Heating and Ventilating Engineers. By exposing to the sun a model theater with interchangeable walls of different materials, they measured the time required

Above, a box-like chamber. representing a theater, set up in the sun to measure heat that passes through wall. Instru-ments mounted outside the chamber record sun's intensity

> At right, observer in laboratory watching electric gages connected with thermometers in theater during the test of wall material

for heat to seep through a wall and make itself fully effective-a time lag that reaches more than six hours with a six-inch concrete wall. Thus a theater may still be warming up after the sun goes down. Designed to yield accurate data for planning air-cooling plants for theaters, the tests showed they must be three to ten times larger than usually estimated. With shiny aluminum paint on the outside of the building, however, less refrigeration would be needed.



Weed Seeds, Buried Thirty Years, Grow When Dug Up and Planted



Upper right, digging up seeds buried for thirty years. Upper left, shaking the old seeds out prior to planting them. At left, bindweed that sprouted from the seed dormant for thirty years

CONTAINER FOR CAR HOLDS FAMILY WARDROBE

CLOTHING for the entire family may be carried in a car, without cluttering the rear seat or the running board with suitcases, by means of a new wardrobe container attached to the top. It is readily removable, may be hung in a closet and

left packed if desired, and may be folded to half its size for easy handling. According to the maker, suits and dresses are kept neatly inside its folds without wrinkling. The device is also suitable for installation in airplanes.



HAMMER HEAD LOCKS ON

HAMMER heads won't fly off when they are fitted with a pair of locking strips devised by a Milwaukee, Wis., inventor. Notches are cut in the handle near the end, and the head is then slid on to the handle with a locking strip on each side. Spring prongs on the strips snap into the notches, and the head can't be taken off.

ILLUMINATED TRACING EASEL SPEEDS ART WORK

ANYONE who has ever tried to hold a picture or drawing against a window pane, in order to trace its outline upon another sheet with pen or pencil, will appreciate the convenience of a new illuminated tracing easel for art or office work. A picture laid upon its glass window is clearly seen through the tracing sheet by the light of a twenty-five-want bulb beneath the glass. The adjustable stand is clamped to a convenient corner of a desk or table, and the easel may be swung out of the way when not in use without removing the clamp. Everything but the glass panel is made of metal.



Amateur's Home Built **O**BSERVATORY

Wins Astronomer's Praise



This mechanism, which controls the telescope, was put together largely of old car parts. It is inclosed in glass

Rare Skill Shown by Star Gazer Who Used Odds and Ends in His Telescope, Mounting, and Housing

HREE years ago, George F. Tauchmann of Berkeley, Calif., knew no more about the stars than the average schoolboy, nor did he have any means of studying them. Now he can range the skies intelligently and pick out and identify the better known stellar bodies. He does all this with his ten-and-one-half-inch reflecting telescope, set up in a two-story observatory with a

set up in a two-story observatory with a regulation revolving top.
Telescope and the observatory were built by Tauchmann. He laid out and erected the building from

foundation to dome, performing every part of the work himself—carpentering, sheet metal work and glazing-except for bending two pieces of two-inch angle iron into half circles to furnish the necessary stiffening for the metal dome, which is thirteen feet in di-

The telescope is built almost entirely of salvaged material. It is mounted on a tall, kitchen range boiler, inside of which hang the weights that drive the mechanism used for moving the telescope to compensate for the earth's rotation. To overcome vibration, the bottom of the tank is imbedded in concrete set in the ground. Both halves of a Ford rear axle housing are used for swinging the instrument-one as the declination axis, the other the polar axis, One still carries half the differential housing and this, filled with lead, serves as a counterweight. Old ships yielded port glasses which Tauchmann ground, polished and silvered. He prepared the glass from the simple, flat, transparent disk as it came from the ship's side, to the finished reflector At present, Tauchmann is working on a

At present, I aucumann is working on a twenty-two-inch reflector for a newer telescope, the construction of which will require all his spare time for a year or more. This will rank as one of the largest amateur-built instruments in the world. The present observatory is large enough to accommodate the new telescope, which will be completely new, including foundation, mounting and mechan-

> Tauchmann insists it is impossible to build anything like a good observatory or telescope without detailed plans. He followed this rule from the start, carefully

planning every step on paper. After a recent inspection of Tauchmann's plant, Dr. Robin Grant Aitken, director of Lick Observatory, said he had seen many homebuilt astronomical observatories, but this one more nearly approached profes-sional quality than ony other

HISHOMEMADE REFLECTOR Below, Tauchmann grinding his own telescope reflector from a ship's old portlights. The glass is revolved by motor while he holds a heavy piece of metal against it. Above, inside the thirteen-foot loservatory showing the complete assembly, with telescope awaing at right angles to the opening

HIS HOMEMADE REFLECTOR

Protect Your Family by Recording Their

Fingerprints To take your own fingerprints, a pane of glass is covered with a film of ink and against this the thumb

and finger tips are pressed until covered with ink. Then print is made on cardboard as shown at the right

The new-born baby's foot is pressed against an ink pad and then held against a smooth finished piece of cardboard upon

which the print of the foot is recorded as shown at the right. Then the mother's thumbprint is taken on the same card to complete the identification

By STERLING GLEASON

EEP a permanent record of the fingerprints of each member of your family.

This is the advice of police, hospital officials, and all others who know the truth about the thousands of mysterious disappearances, kidnapings, and suicides that occur annually. Various agencies will make such a record for a moderate fee. Police, in a number of cities, have volunteered to make a fingerprint record of children without charge for the parents who request it. No record is kept by the police, the impressions being turned over to the parents for their own use.

Such a record, along with a physical description and a photograph or two. can be kept among family keepsakes, and in case of emergency might furnish the clue that would restore a missing loved one to you, or frustrate the plans of criminals. If, for example, the fingerprints of the Lindbergh baby had been on file, his parents need never have paid \$50,000 to impostors who did not have the child in their possession.

Many hospitals now take footprints of



can make a record of your own fingerprints similar to this one made by the Los Angeles police department by putting each print in a labeled square, rolling fingers to get clear impression

new-born babies, to prevent mix-up of the infants. The fingerprints of the mother are also recorded so as to prevent subsequent doubt as to the parentage.

You can yourself easily make a finger-print record in standard form that can be utilized by the identification experts. To do this, rule off ten squares on a smoothsurfaced card. Printer's ink should be used to make the impressions, although smooth

Ink film for staining finger tips can best be applied to pane of glass with a rubber roller. Distribute ink evenly and roll the fingers to get ink into the depressions

paint, dried until it is tacky, will do. If a rubber roller is available, rub it with ink, then roll it across a pane of glass, leaving a black film upon the surface. Or, simply apply the film with a cloth.

Next, ink the fingers by pressing them down upon the glass, and transfer an impression to the card, placing the print of each finger in a separate square and labeling it. In taking the impressions, press the finger hard against the card and roll it slightly to each side to get a complete pattern of all the tiny ridges. Do not, how-Next, bunch the fingers and make a complete print of the fingers of each hand

On the back of the card may be attached a pair of photographs, preferably a front and side view, and if desired, a pair of footprints. Other data which should be included are height, weight, color of hair and eyes, date of birth, build, complexion, any scars or identifying marks, and a specimen of the handwriting or signature. Stored away in a safe place, such a record may prove to be worth many times its cost.

Streamlined Auto Designed by German Airplane Factory



Aerodynamic principles are incorporated in stream-lined car shown above. At right, compartment for spare wheel in side of hood, with door open for removal

ARTIFICIAL FOG SAVES GARDENS FROM FROST

FIGHTING frosts with artificial fog will be tried in Germany this fall, in the vicinity of Hamburg. It is expected vegetables will be protected by clouds of chemicallyproduced mist. Into drums of unslaked lime, dissolved sulphur trioxide will be allowed to drip when the farmer receives frost warnings from weather bureau headquarters. The reaction will produce the protecting cloud of vapor.

NEW CIRCULAR SAW CUTS AT ANY ANGLE





Skeleton put togethof connecting er of connecting rods, springs, and vises is used to ad-

vertise a manu-facturer's products

SKELETON ADVERTISES FACTORY'S PRODUCTS

To advertise his products in an unusual way, a Hartford, Conn., manufacturer constructed the giant "skeleton" pictured above and placed it on exhibit. Its bones are formed of connecting rods, springs, and vises, while the skull of the monster contains bobbins and rifle triggers.

rollers and is so delicately balanced that it may be swung with the little finger. The motor

shaft is in line with the pivot of the moving table. Gradua-

Designers of the famous Junkers airplane firm of Germany have now turned their attention to the improvement of motor cars, with the result that advanced aerodynamic principles are built into a new automobile offered to the public. Its streamlined body, devoid of projections, is designed to minimize wind resistance and consequent fuel consumption. Fenders and running board melt into the smooth profile, and even the door handles are recessed. A compartment in the side of the hood houses a spare wheel, and the interior of the rear end provides space for luggage.



LITTLE piles of sand are revealing hitherto unknown secrets of steel, in the hands of Dr. A. Nadai, Westinghouse research engineer, In particular, the sand models show the exact amount of force required to twist and deform steel bars of various cross sections. If a steel bar is twisted just a little, it will spring back unharmed when the pressure is released. More force gives it a permanent twist by exceeding the bar's limit of elasticity, and enough force will break it. Dr. Nadai measures the last two forces thus:

First he cuts a piece of cardboard exactly to the size and shape of the bar's cross section. Then he piles upon it as much fine, dry sand as will stay there without spilling over the edges. This heap



takes a geometrical shape determined by the shape of the bar. The volume of this sand pile, Dr. Nadai demonstrates mathematically, is almost exactly in propor-

with sand piles. At left is test chamber used to produce sample at right, in which white areas show where bar yields tion to the amount of force required to

give the bar a permanent twist.

Another experiment shows how the metal becomes plastic and "flows," under enough force, to take a new shape. A hollow glass shell is constructed in the shape of the sand pile, and coated on the shape of the same pire, and coared on the inside with oil. Then a membrane of thin rubber, stretched flat, is sprinkled with powder and forced into it by air pressure, supplied by a tire pump, in an especiallyconstructed air chamber. White marks, adhering to the oiled shell where the powdered membrane has touched it, show the parts of the bar's cross section where the metal first yields or "flows." While the mathematics used in proof of this is complicated, the test itself is simple.



German boys build their models of famous ships large enough for them to go sailing in

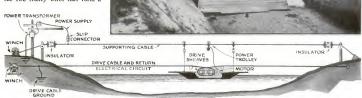
BUILDERS RIDE MODEL BOATS

SCHOOLBOYS of Potsdam. Germany, have gone in for ship-model-making on a larger scale than many of their American rivals. Under the direction of Max Bartsch, naval engineer, they are turning out seaworthy craft large enough to sail with their constructors aboard. The pho-tograph reproduced here was taken just after the launching of two of the remarkable m o dels-representing the cruiser Hindenburg, seen at the right in the picture, and the five-masted training frigate Preussen-in the river Hadel, near Potsdam. The miniature Preussen measures twenty feet from bow to stern. One of the boy model builders can be seen seated within the hull of the Hindenburg,

Ferryboat Crosses River on Trolley Wire

AN ELECTRIC ferryboat that runs on a trolley wire, believed the first of its kind, has just been tried out successfully in California. Carrying twelve automobiles at a time, the flat-hottomed craft plies back and forth across the Sacramento River at a speed of approximately 180 feet a minute. It thus makes the crossing, loaded with twelve cars and passengers, in about two minutes. Its cost of operation is estimated at one-half that of an ordinary gasoline-engine ferry. The boat pulls itself across by one of the two trolley wires that form a







First electric ferry to run on trolley wire is shown at top moored to bank of Sacramentor River. It carries 12 cars at a time. Diagram gives arrangement of cables that can be lowered into water without short-circuiting. At left, close-up of ferry's motor and one drive sheave complete circuit to carry current to the motor in the craft. Because the Sacramento River is a navigable stream, and the trolley cables must be dropped to the bed of the river to permit up and down traffic to pass, the engineers who designed the ferry were presented with an unusual problem. The wires must be bare for the trolley wheels to make contact with they must not short-circuit. The difficulty was solved by insulating the "live" cable at each end and energiagit through a "slip" connector, a foolproof device which automatically shuts off the current when the cables are lowered into the stream by hand winches. The railroad commission of California has approved the installation of the strange ferry.

GROWS STRAWBERRIES IN OLD AUTO TIRES

A STRAWBERRY garden has been made from discarded auto tires by a Pasadena, Calif., disabled war veteran. He stacked a dozen old tires, with six two-inch holes cut in the tread of each, and filled the inside with earth. Strawberry plants are put in the upper holes.

AUTOMATIC SHUTTER FOILS WINDOW THIEF



As the brick is hurled through this display window, the jointed iron shutter drops down and automatically locks itself to prevent theft

To FOIL the thief who smashes a jewelry store window, a London, England, inventor has devised a shop window that is declared to be proof against looting. A jointed iron shutter is poised at the top of the window, on the inside. The moment the window is broken, the shutter is released. It drops across the win-dow display and automatically locks at the bottom. At the same time an alarm is sounded. A demonstration of the new device was recently given when one of the shutters was installed in a shop. The inventor hurled a brick through the window. Promptly the shutter descended and locked.

NEW ABRASIVE CLEANING STRIP IS FLEXIBLE

Hansv for cleaning the contact points of a car's ignition system, and for smoothing down the commutators of electric motors, is a new, flexible strip bearing an abrasive. Because of its thinness and flexibility, it gets into places where an ordinary grinding stone could not be used. Even the hardest metals, such as tungsten and platinum-iridium alloy, are easily failed to short the flexible abrasive strip does not short-fireuit an electric current, it may be used to dress a motor's commutator while it is running.



This abrasive strip, thin and flexible, can be used to clean in corners usually inaccessible



FLOODLIGHTS BRING MIDNIGHT GOLF

"FLOODLIGHT golf," played at night by the aid of powerful lamps, now provides recreation for many who cannot enjoy the sport by day. The photograph above shows the result of lighting a green at a San Francisco course, one of the first to initiate the new style. The installation comprises more than a hundred 1,500-wall lamps, and engineers say that there is twice as much light on the fairway and the rough as is ordinarily thrown on the average office desk.

ENGINE BURNS ITS CARBON MONOXIDE





PORTABLE SEARCHLIGHT HAS HALF-MILE RANGE

A New portable searchlight, capable of lighting up an object a half-mile distant, has been placed on the market. It weighs thirteen pounds and draws its current from a storage battery of fitteen ampree-hour capacity. The battery will keep the light burning steadily for seven hours.

OIL PENETRATES METAL

Discovery that oil penetrates metal, instead of merely forming a clinging film on its surface as formerly supposed, may improve lubrication methods. According to two experts who recently reported this surprising fact, oil may be wiped from the surface of a bearing and a new film will soon appear.

OUT OF THE AIR



F EVER I meet a silkworm, I ought to tip my hat three times.

That is the number of occasions—once in moonlight over the Pennsylvania mountains, once above a railroad track in Indiana, and once in blinding fog over Georgia—that parachute silk has saved my life.

A big moon was tipping the treetops, one October night in 1925, when I took off from a little field near Hagerstown, 10 to the other state of the

Everything was going smoothly when I passed Beliefonte, Pa, where mail planes land. A few minutes later, two clusters of pin-point lights, marking the towns of Snow Shoe and Sugar Camp, slipped past under my wings and I headed out over eighty miles of bad mountain country to the north.

It was almost ten o'clock and I was only an hour from Rochester when, without warning, the ship gave a sickening drop. I peered out the right side of the cockpit. The trailing edge of the lower wing was flapping in the moonlight. The rear spar, probably weakened by dry rot.

had snapped off at the fuselage. I cut the switch, flipped back the catch of my safety belt, and dove headfirst over the left side of the cockpit into space.

As soon as I was clear of the plane, I

As soon as I was clear of the plane, I yanked the rip cord and the parachute opened. I was still 500 feet in the air when the ship crashed, half a mile away. A thirty-foot sheet of flame shot up from the wreck, tinging the trees and clearings with red. I landed in a little open space that had once been a potato pack. Carnetted across the rough timbertand in search of a farmhouse.

Half an hour later, I found a winding mountain road and followed it for miles until I came to a house in a valley. Here, an old man got out a battered runabout and took me to Towanda, Pa., where I caught a train for home.

In all, I have come down out of the sky inl, parachutes fifteen times, including three emergency jumps. People often ask me how it feels to fall hundreds of feet through space before the parachute opens. They want to know if the rush of air doesn't choke you and if the sensation isn't like falling in a nightmare.

On first jumps, you usually hold your breath until the 'chute pops open. Later you bail out breathing naturally. I have never heard of a jumper bothered in breathing by the rush of air, even though the velocity of the fall may reach two miles a minute. The sensation is hard to describe. It isn't anything like a night-mare. As you plunge downward, the air seems to buoy you up. The feeling is a little like falling on a feather bed.

I remember one rookie plot who made

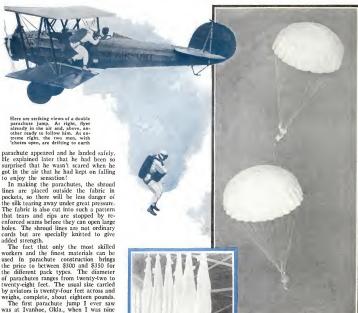
his first jump from a plane I was flying. When he crawled out on the wing at 2,000 feet, his face was as solemn as a boiled owl's. But he was game and dove off. I went into a steep spiral to watch him fall. He dropped and dropped. I was in a cold sweat. Then, when he was only a black dot, the white mushroom of the



Leaving a plane for a paracitate jump

All the Thrills of Leaping into Space from an Airplane Are Packed into This Article by RANDY ENSLOW, Veteran Pilot

ON A BAG OF SILK



The first parachute jump I ever saw was at Ivanhoe, Okla., when I was nine years old. Our family drove in from the ranch to see a woman in red tights drop from a hot air balloon. When she landed, the balloon sailed away over the prairie like the setting sun.

When Capt. Albert Berry made the first

descent from an airplane at St. Louis in March, 1912, he had a big metal cone attached to a crosspiece in front of Tony Jannis' Benoist biplane. This held the silk and kept it from tangling. Later, the parachutes for airplane jumps were packed in big canvas bags.

I made my first jump with one of these bag type 'chutes near Deepwater, Mo., in 1921. My brother and I were barnstorming with a standard plane. The peo-ple were all going up for rides so we thought we would give them an extra treat. We packed the 'chute in the big canvas bag and tied it to the outer strut at the tip of the lower wing by means of ropes. Then we snapped the ends of the harness straps to a bracing wire to keep them from whipping and took off.

At 2,500 feet, I crawled out on the

Modern parachutes are compressed, after being carefully folded, into square or oblong packs of khaki canvas. They are worn in three different positions: strapped to the chest, the back, or, in most cases with aviators, in such a posi-

tion that they form a cushion to sit on during flight. A "pilot 'chute," equipped with a spring so it pops out like a jackin-the-box when the rip cord is pulled. helps drag the main parachute out of the pack so it opens in the quickest possible time after the ring is jerked.

wing, unsnapped the straps, fastened them to my harness, and then swung down, dangling under the wing. The bag was

closed with a laced cord and a bow knot.

When I reached up and jerked the knot, the whole inside of the bag fell out and I

dropped, the 'chute opening as I fell,

My first emergency jump was probably the most amazing escape I have had in sixteen years of flying. It was all over in a few ticks (Continued on page 101)

Before the parachutes are packed in their bags, they are hung up in a high ceilinged room and thoroughly inspected to be sure no defect may bring disaster in an emergency

fought with gas and bomb attacks from the sky, as suggested in this drawing, has led to the invention in France of the new gas shelter shown below. In it a family would be safe from gas for many



Germany, also fearing gas raids from the air, is training her soldiers and war dogs to wear gas masks. The photograph shows a dog, masked for safety, being held in the deadly fumes to accustom it to experience

New Shelter from Poison Gas

TESTED IN FRANCE

ROUND a little house with a conical roof, exhibited in Paris the other day, a knot of excited Frenchmen gathered. It could be erected quickly in any small space, the inventor declared, for protection against a poison-gas attack. When the owner's family hurried into the concrete shelter and slammed the air-tight door, they could live for hours, or even days, sustained by oxygen apparatus.

Strange to American minds, the thought of a gas attack is no empty bogey to many Frenchmen. So seriously do they take it that gas masks have actually been placed on sale in French shops, and were advertised last winter as "ideal Christmas gifts!" Germany, meanwhile, has begun a national campaign to train the public in self-pro-tection from gas raids. Russia is reported to require as many floors underground as above ground, when feasible, and rooms convertible into gasproof chambers, in newly erected buildings.

What has made continental Europe so "gas-minded?" As a French military ob-server points out, aviation's rapid strides now bring danger of air raids and gas bombs to cities far from battle fronts. If another war comes, noncombatants will be exposed to more terrible perils than ever before. Faced with such a menace, many European countries are making nationwide plans for civilians' protection,



a modern German Paul Revere, with a siren on his bike, ready to spread a gas attack alarm. At right, masked Berlin workers making their way to gas shelter



New War Tank Jumps Ditches



hoicis at tull speed.

The new tank owes its leaping ability to powerful springs on which the wheels are mounted. Their exact construction is the secret of J. Walter Cartistic, but the U.S. Army and inventor of the new jumping tank. It is known, however, that the springs make the tank leap upward when it hits a bump at full speed, much as a springboard gives a diver a boost.

In actual combat the driver, crouching in a padded seat behind a steering wheel like that of a standard motor car, clears a trench by a fast take-off from a suitable raised spot.

His skill in choosing the place of leaping, and his speed, determine the length of the jump. The springs absorb the terrific impact of landing.

Remarkable aside from its jumping, the new 1,000-horsepower tank is believed to be the fastest ever built. Stripped of its endless treads, it was clocked at 110 miles an hour. Three-inch guns serve as armament.

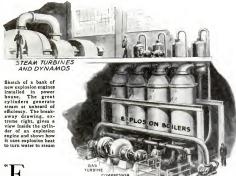
Soon Christie plans to fit his jumping tank to be carried from place to place by a large airplane. This innovation in warfare is a modification of his original plan to equip the tank with wings and propeller to fly it under its own power—a project that may be worked out later—

Below, removing the endless treads from the jumping tank to try its speed when running on rubbertired wheels. Above, tank without treads ready for test on smooth road where it went 110 miles an hour

At left, view of front horizontal, incased spring on jumping tank. Details of the spring are a secret but it is the spring that gives tank its power to jump



Explosions Drive Giant Turbines



OR TURBINE

TXPLOSION boilers," resembling giant automobile

cylinders, will soon turn water into steam to drive turbines of ships and power houses. The boilers will be, in effect, the biggest internal-combustion engines in the world. Each one is large enough to swallow an entire automobile and more. Animated by oversize spark plugs, the cylinders chug-chug with a slow, measured beat, but the concentrated head the temperature of the concentrated head to the cylinders are the concentrated head to the cylinder as surrounding jacket.

Ordinary steam boilers, domestic and

Ortainary steam boilers, domestic and industrial, burn their fuel under normal atmospheric pressure much in the fashion of a kitchen range. Seeking greater efficiency, engineers of the Brown-Boveri firm of Switzerland, designers of turbines and other machinery for some of the

world's largest power plants, conceived the idea of burning fuel under pressure and even exploding it. A compressor forces the fuel—gas, oil,

Asoline, or coal dust—into the mammoth combustion chamber. Inlet valves close, and spark plugs ignite the mixture from forty to sixty times a minute. After each explosion, exhaust valves open, and scorching exhaust gases, bearing the heat energy of the explosion, rush out through tubes in the top of the boller. Here they turn water that surrounds the tubes to steam. Led down the side of the boller, the exhaust gases give up their remaining heat



to warm incoming water in a preheater. Finally the cool gases, still under pressure, enter a gas-driven turbine, rotated by their impact, which furnishes power for the compressor that feeds the boiler.

Meanwhile, the steam is freed of water in a centrifugal separator and re-heated in a superheater coil within the explosion chamber of the boiler itself.

Just as a motorist regulates the speed of his car by stepping on the foot throttle, so the output of the new explosion boilers is controlled at will by regulating the rate at which fuel is supplied. For starting, an auxiliary motor or turbine operates the compressor, and it may be cut in again at any time if the turbine is insufficient.

Tests with an experimental explosion boiler at Baden, Switzerland, are reported to have shown almost unbelievable efficiency, indicating that it is possible, by this method, to extract more than 100 percent of the heat that the fuel theoretically contains. The apparent paradox is explained by the fact that the exhaust gases, first cooled and then allowed to expand, are finally discharged at a temperature actually lower than that of the surrounding air. This "heat pump" effect has never before been used in such a machine.

AUTO ON CABLES IS RIVER FERRY



ONE of America's strangest ferries, a standard motor car running on suspended cables, now carries passengers across the Pudding River near Barlow, Ore, Two Barlow, strands support the car, which runs under its own power, while a third. through a pulley cradle, steadies the vehicle at the top. The only alteration made to the car consisted of removing the tires and placing flat rubber bands around the rims for traction. The owner of the ferry says he can make the 120-foot crossing, 1,760 times on a gallon of gas,

I Can You nvent It?

ERE is a coil of round brass spring wire, open-wound, as would shown in the diagram. How you make use of this coil to produce a look with the diagram, the work of the same diameter of the soil to the same diameter of the soil to the same diameter of the soil in any way? You are free to make any additions you wish, but the coil of wire, as shown, must be included in the finished tube. The solution of this interesting problem, which you are not likely to find especially difficult, will be published in the November issue of this magazine.

Last month you were shown a diagram illustrating the action of an ordinary typewriter. You were asked to modify the mechanism in such a manner that the clatter of keys on the platen roll would be eliminated so your invention would result in a noiseless machine. Here is one solution of this very interesting problem: When the key A is pressed downward, the force transmitted through bellcrank B, link C, and lever D acts upon the jointed type-bar E, straightening out the bend and pressing the type F into gradual but forceful contact with the platen roll G. This eliminates the hammer-blow which makes the ordinary typewriter so noisy. The platen G should be made of metal, instead of rubber, so the gradual "squeezing" between type and platen may make as good carbon copies as the hammer-blow stroke. You probably thought of other solutions to this practical problem but the one given here is the simplest and most satisfactory that could be given in a limited space.

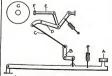


Diagram showing how to solve last month's problem regarding a noiseless typewriter

Baffling After-Dinner Stunts

CIGARS or cigarettes are practically all you need to perform a number of amusing and baffling stunts suitable for the relaxed period that follows a full dinner. Six of them are illustrated and explained on this page and only a couple of minutes' practice will be needed to enable you to do the most difficult of them. Once mastered you will get a lot of fun using them to dumfound your friends.



LIGHTING UP AT A DISTANCE. A match that is held six or eight inches below the end of a eigarette will light it as quickly as though it was quickly as though it was the control of the con

MAGIC CIGAR
STICKS TO HAND
The position of the thumb
has nothing to do with
the clinging nature of the
cigar. A hooked pin is put
heneath the band and the
point clings to the hand.
Smooth gestures then will
not dislodge the cigar.
When passed to guests for
examination the cigar is
quietly slipped off the pin

A VANISHING CIGAR BAND. The band is in plain sight on the cigar but a slight atoming the plain of the gers causes it to disappear. To do, and rick, remove the band, cut it in two, and glue one-half back in place. Then the hand vanishes as the cigar is turned



SMOKE WITH YOUR HANDS. Hold a cigarette as shown above with the hands tightly clasped. As the hands the hands the hands tightly clasped. As the hands the ha

Find Mother-of-Pearl Clouds Fourteen Miles Above the Earth



or more observatories and measuring the relative displacement in the pictures. Thus he showed mother-of-pearl clouds to be far above the level of cirrus, the feathery ice cloud sometimes

described as the loftiest of all the clouds. This discovery has heightened interest in another phenomenon, the "noctilucent" clouds seen during summer nights. They

the loftiest of all clouds

are bluish white and not iridescent, and are believed to be dust clouds. Early observations indicate a possible height for these clouds of fifty miles or more,



WARNING AT ROADSIDE PROTECTS PEACOCKS

Motorists on the boulevard near Arcadia, Calif., may see the odd sign pictured here, believed to be the only one of its kind in the country. Its warning concerns the welfare of Baldwin Ranch peacocks that occasionally cross the highway. The boulevard, smooth and wide, tempts to speed and hence the warning sign seemed necessary.

COPY 800 TREE LEAVES ON TABLE TOP

COMPLETE lessons in botany are embodied in a "nature table designed by David French, of Pomona, Calif. It contains more than 800 inlaid copies of leaves from different species of trees, faithfully executed from tracings of real leaves and made of wood from the trees represented. French spent twenty years collecting specimens of wood, including such varieties as mountain nahogany, camphor, orange and nine kinds of eucalyptus. An old stump standing unnoticed for a quarter century on a

mountain road in Eldorado County, Calif., furnished a sample of incense cedar. The fragments, assembled under French's direction, make an unusually handsome piece of furniture. It is embellished with appropriate inlaid quotations from Emerson, Whittier, and Browning.



POPULAR SCIENCE MONTHLY

copies of different

leaves are inlaid in this table top

Whirlpool Tube Puts Hole in Sea



Fast Electric Car Tests Planes



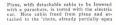
Full sized clinogree, a new present plane resembling and a clinogree and plane resembling and a clinical car for a flying test clinical car flying test clinical

Above, loading an aircraft rocket with six pounds of powder for test at French field. Right, watching the rocket burn

ANY a hopeful inventor's dreams are vindicated or blasted at one of aviation's strangest proving grounds, not far from Paris at St. Cyr., France, by a little electric car that runs along a railroad track with a third rail for power.

thard rail for power.

Diminutive models or full sized aircraft are mounted on this car and whisked down the track at mile-a-minute velocity. Instruments on the car make a constant record of the exact speed, wind pressure, and strain on the machine undergoing test. Thus its behavior under actual flying conditions is determined before it takes to the air. The electric test car plays much the



same role as wind tunnels used elsewhere for tests of airworthiness, in which the airplane or model is held stationary and air is blown past it.

Latest of the devices to be tested upon the odd railway under the direction of the French air ministry was a model of an air-plane with a detachable cabin, designed to lower passengers of a disabled plane to safety by means of a giant parachute. The "clinogyre," a new French craft strongly resembling the autogir on appearance and principle, and a helicopter designed by the French engineer Damblanc, also had their try-outs on the electric car. Other tests were made of a new rocket motor.

POPULAR SCIENCE MONTHLY



With wire saw, below, rock between shafts is cut away. The post n and guide wheels are lowered to follow the cut



Odd Rock Test Makes Dam Safe

Lowered into man-sized drill holes, experts recently passed upon the rock foundation for the proposed Prettyboy Dam site upon Gunpowder River to increase the water supply of Baltimore, Md. For this means of making a deep examination, shafts nearly sixty feet deep and a yard in diameter were sunk by a calyx drill. Geologists of Johns Hopkins University, who went down the holes, found the rock weakened by past geologic upheavals but able to support the proposed dam if care were taken not to iar the rock in excavating for the anchor-

This ruled out blasting. Again the calyx drill was put into service. Its cutting tool is a steel barrel without a bottom, revolved rapidly by a motor-driven shaft. The lower edge of the barrel is slotted. Hard steel shot, fed into the slots, rub against the underlying rock, grinding a circular groove. From time to time the rock core in the tool is broken loose and lifted out. Thus fifty shafts were sunk.

"Wire saws" were then used to cut away the rock between the shafts. These are endless, motor-driven cables fed with water and sand, and held against the rock by tension posts set in pits. Guide wheels, over which the cable travels, may be screwed down to maintain cutting pressure. In this unusual fashion, the rock was cut without jarring the foundation.

TROLLEY CARS NOW TOURIST CABINS



Trolley car, with wheels removed, becomes attractive summer cabin

WHEN a trolley line between Carlisle and Mount Holly, Pa., discontinued operation, an enterprising hotel-keeper purchased the cars and made them into tourist cabins. Choosing an attractive site in a wooded grove between the two towns, he jacked up the trolley cars, removed the wheels and mechanical fittings, and attached neat trellises on both sides. A partition divided the interior of each car into two rooms. Beds, tables, washstands, and electric light completed the equipment.



TREES SUGGEST ARIZONA DROUGHT IN 300 YEARS

To FORECAST rainy and dry seasons, engineers planning a big hydroelectric development on Salt River, Arizona, have been taking borings of tree trunks. Rings of growth, they say, have shown droughts in the years near 700, 1000, 1300, 1600, and 1900 A.D. The regularity of their recurrence forecasts a drought in 2200.

HOW THE MACHINE Cobberies

Amazing Exploits of Organized Gangs Who Steal an Entire Railroad, Loot Museums, and Take Autos by Wholesale

gang, organizing ability is evident.

Last winter two unusual jobs were pulled off. A quantity of ice was stolen from a city reservoir in New York State. The ice was expeditiously harvested and removed-

a cool job if there ever was one. And who could hope to identify ice as his own?

About the same time, two pro-prietors of a Brooklyn, N. Y., clothing store unlocked their doors for the day and found that 300 suits and overcoats had been stolen during the night. Such things are hard to trace in a large city. They change hands quickly. Following close on this theft,

Boston thieves lifted half a million razor blades from a garage where they were stored awaiting shipment. The \$30, 000 worth of double-edged blades would

supply the entire underworld with close shaves for a long time.

Sharpers along a different line caused an unexpected drought some months ago. In the dead of night they carted away a halfmile of lead pipe from the Enfield, Mass., water system. Many were deprived of water, and one can imagine their amazement as well as indignation. We expect water pipes to "stay put."

In connection with water, the report of a queer theft

comes from Chicago, Ill. A man in that city was arrested recently for making away with 125 bathtubs!

A million barrels of crude oil is another item on this list of bigger and bolder robberies. Not long ago, Texas rangers placed a dozen men under arrest in the East Texas oil field on a charge of tapping pipe lines from five wells and stealing that amount of crude oil. By means of bypasses, or pipes leading around the flow-

spoils and pay off the recording meters, they had obtained the oil over a period of more than seven months and shipped it to refineries without being detected.

Two million wasps formed the strange loot of thieves in another large scale robbery in California. The insects, known as gall wasps, were stolen from the fig ranch of Dr. H. C. Moore, near Merced. These insects, which produce balls on the leaves of oak trees, are bred in large numbers for use in the fig orchards where, in laying their eggs, they fertilize the blossoms by carrying pollen from flower to flower.

For sheer nerve it would be difficult to outrival the "live-wire" thieves of Michigan-the state that produces twothirds of those swift vehicles which make wholesale robbery possible. Last October officials of the Consumers Power Company were simply astonished when told that 150 miles of copper wire had vanished from the high-tension lines between Grand Rapids and Marshall!

The lines at the time were carrying a heavy load of current. The robbers must have climbed the steel towers, risking in-

stant death, to cut loose the heavy wires. In some unexplained way, they side-stepped the 144,000-volt electrocution that awaited them and removed sixteen tons of con-

The theft, unique in the power world, must have caused the owners of the world's greatest diamond mines, in South Africa, to wonder just how effective their electrified barbed-wire entanglements would be against such modem Big Business robbers.



the loaded truck away.

driver leaped into a taxi and gave chase, re-covering the truck when it crashed into a car

said. And that was that. The 400 square yards of turf were duly replaced, but the mystery of how this remarkable theft was "pulled off" in a single night, without raising an alarm. remains unsolved. Only a well-organized band with plenty of men, trucks, guns, and nerve could have done it. Many large thefts recently have been

Risking death at every instant, thieves cut loose and made off with 150 miles of copper wire that was at the time carrying a 144,000-volt current

N A bright sunny morning, the

manager of a Long Island, New

York, golf club began his round

of inspection. He whistled as he

walked over the velvety fairway soon to be trod by light-hearted golfers.

at least for the manager.

the nearest police station.

Well, I'll be .

Then the sun seemed to stop shining,

His fifth green, his favorite, where was

He broke all records, golfing, running,

and leaping, from that spot to his office. His language outdid anything uttered

theretofore on that course as he phoned

sergeant. "Stole your whole golf green?

Two detectives, after four days of work, found that lost green. That was quick work, for they had a large island to

search, much of it covered with green. The lost fifth green was found neatly

stacked in a cemetery miles from the golf

course. The thrifty keeper had purchased

the truckloads from some young men, he

'Stole your what?" ejaculated the desk

achieved without leaving a clue. From the "pick-up" men to the final "fences," and the shady financiers who sell the

N. J. The driver and helper were forced into a sedan, and two masked men drove POPULAR SCIENCE MONTHLY

Stealing motor cars does not pay. Three

out of four are recovered, often by insur-ance company sleuths. But wholesale

thieves have succeeded in getting away

with whole truckloads of valuables. Not

long ago a large truck, loaded with nearly \$5,000 worth of motor accessories, was

held up by armed men near Roselle Park,

AGE HAS LED TO

on a Gigantic Scale

ORVILLE H. KNEEN

Last year, in a raid on New York's garment center, a truckload of clothes worth \$20,000 was driven were captured, but the driver got away with the loot. In another holdup \$22,000 worth of cigarettes were taken. Trucks played their part when eight men stole eight tons of peanuts from a storage house in East Albany, Ga., a short time ago.

An attempted truck robbery failed when thieves forced a driver to turn over his truck loaded with \$6,500 worth of silk. The driver leaped into a taxi and gave chase. The fleeing truck ran

their haul. Three days later six bandits, with sub-machine guns and sawed-off shotguns, made away with \$30,000 worth of silk, about 12,000 pounds. The driver and his helper put up no fight when they saw the battery of guns.

Soon after that coup, six gunmen got





Frequently in truck thefts neither machine nor valuables can be found. They vanish and the insurance company pays the losses.

Stealing a single automobile is no longer profitable, but taking a job lot is another matter. A patrolman in Newark, N. J., stopped on his beat to admire the bright new cars in a large showroom. When, some hours later, he again passed the windows, every car had vanished! Fifteen of them, the entire stock, had been removed, and the lock was unbroken, That would have been a good case for Sherlock Holmes himself.

European thieves are more discriminating in selecting their loot. Not long ago ten valuable paintings were stolen from a collector's office in England, along with rare Persian silk and woolen rugs, Flemish tapestries, and ivory carvings. Not a sound was heard during the robbery. At Vienna an arsenal was looted of museum pieces consisting of 200 golden crosses, an antique silver statue of an ox filled with ducats, and other treasures of great his-

O ONE has stolen a complete museum -as yet-but last spring Joseph A. Fuerstman, a lawyer of Newark, N. J., had almost that experience. He repaired his two and one-half story frame house, built a new fence around it, and offered it for rent. A month later when he went to

look at it, he found only the cellar left.

Detectives found that families living on the street had torn down the house and fence piece by piece, using the lumber for firewood

In Rockville Center, L. I., the other evening, when Fred Willard returned with his wife from a moving picture show and turned his car into the driveway, he could scarcely believe his eyes. A fifteen-foot flowering magnolia tree, which had been in full bloom on the lawn when they left for the theater, had disappeared. Neigh-bors recalled having seen a truck, apparently having motor trouble, stop in front of the house and a gang of men dismount. No attention was paid to them and the tree

was not missed until the owner returned. New Year's pranks are not always humorous. Last year a former motorman stole an empty trolley car from the barns, and ran it for seven miles. No doubt he got the kick of his life by passing up all the waiting passen- (Continued on page 99)



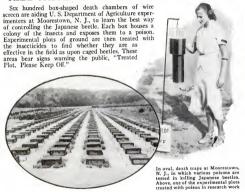
Returning from the theater, this Long Island couple found their 15-foot magnolia tree gos

Smokestack Is Ventilator in New Liner



New French liner that has only one streamlined funnel which is also used as a ventilator, air being drawn in underneath the rim and forced into all parts of the big vessel

KILL JAPANESE BEETLES IN NEW TRAPS



HOLES IN SPECTACLES SHUT OUT GLARE

GLARE-PROOF goggles consisting of aluminum cones fitted to the rims of spectacle-like frames have been invented for night driving. The user watches the road through small holes near the apex of the cone. The holes, slightly to the right of the apex, automatically cut out the light beam of an approaching auto. When meeting a car at an intersection, the wearer, tilting his head forward a little, lowers the apex holes, and prevents the light beam from entering the eye. Holes of the same size on the outer sides of the cones give a view of the sides of the road at all times.



Holes near center of these driving glasses shut off light beam and prevent glare; holes at side give lateral vision

SMOKESTACK, ventilator, and grand staircase are combined in one on the new French liner Champiain. To reduce air resistance, the huge funnel is streamlined. An oval center passage carries the smoke away while fresh air, entering the funnel under a rim extending around the entire top, is used to ventilate the vessel. Below, the passage house one of the grand staircases, passengers entering through two doors at the base of the funnel.



Close-up of double service funnel which, shaped like a big flatiron, holds stairway

USES AUTO'S ENGINE TO RUN SCISSORS GRINDER

JUNKING his horse-and-wagon outfit, a New York scissors grinder fitted a portable grinding unit of his own design upon the fender of a car. The engine drives it



POPULAR SCIENCE MONTHLY

Masked Flyers Spray Insect Poison



ROBOT ANSWERS PHONE, TAKES MESSAGE

bell rings, an "exploring coil" in an attach-

ment mounted just above the bell box is energized by electrical induction. It

waits just fourteen seconds, and then

operates an arm lifting the telephone receiver from the hook. A phonograph at-

tachment informs the caller that the

robot will record the message.

THREE PLANES WRITE BIG QUESTION MARK IN SKY

QUESTION marks a mile long were written in smoke recently in the sky near Rome, Italy, Flying in formation, three pursuit planes wheeled above an airfield trailing white clouds of chemical vapor. A fast, merry-go-round circle left a dot in smoke. Then a sweep across the sky formed the rest of the question mark.

A SECRETARY that never talks back is the invention of S. Young White, New York engineer. His robot will answer your phone and take the caller's message. It will also make a call for you; for example, if you want a long-distance message transmitted at night, you have only to dictate it to the automatic secretary and it will call up the party, deliver the message at any predetermined hour, and record the reply.



phone bell box and is operated by induction



This 1.380-foot span will cross the East River but it will be only a small part of the 17.000-foot bridge planned for New York

New Three-Way Bridge for Cars Will Be 17,000 Feet Long

New York, city of islands, now plans to solve one of its knottiest traffic problems with a three-way bridge for motor cars. The Y-shaped structure, carrying vehicles between the boroughs of Manhattan, Queens, and the Bronx, will save untold time for motorists who now use ferries or make long detours to existing bridges to cross the natural water gaps separating the boroughs.

By virtue of its magnitude and design, the new Triborough Bridge will be unique among engineering projects. Its three arms will total more than 17,000 feet in length. including a 1,380-foot span across the East River that by itself would rank among the great suspension bridges of the world. All arms join at a level high above the ground of Randall's Island, With three streams of traffic converging at this point, a ramp has been designed to distribute cars in the direction they wish to travel. Engineers estimate the bridge will cost \$32,000,000.





Upper view shows the ingenious ramp of three-way bridge that will permit traffic to direction it pleases. Above, air view of a model of the entire Triborough Bridge, seen from Queens AIR BLOWER DRIVES STRANGE FRENCH BOAT

DEVOID of propellers is a new French craft that runs by "jet pro-pulsion." Its power plant consists of a four-cylinder, sixteen-horsepower gasoline motor driving an air blower. Compressed air from

the blower is shot toward the stern, along open slots on the underside of the hull, propelling the craft forward at a speed said to attain nearly forty miles an hour. The flat-bottomed boat draws only nine inches of water.



FLIES RAISED TO ORDER FOR INMATES OF ZOO

Pampered captives at the National Zoological Gardens, Washington, D. C., enjoy a diet of flies raised especially to their order. Bred in the pyramid-shaped cages of the "fly farm," as shown in the photo, the insects are collected in milk bottles and fed to frogs and lizards.



Strange French bost, with nine-inch draft, which is driven by compressed air from a blower

"Flying Fish," Our Army's Newest Plane, Hits Terrific Speed

STREAMINING gives the U. S. Army Air Corp's newst plane the appearance of a flying fish. The machine is known officially as a semilous wing monoplane for light bombardment, and military utility has dominated its design. It is constructed of aluminum alloy throughout. The landing wheels are drawn up in flight, reducing air resistance and approaching the much-sought aeronautical ideal of a flying wing. Two powerful engines mounted on the wing propel the machine at terrific speeds.



Highly streamlined, this newest of the U. S. Army planes gives the appearance of a flying fish when in the air. It is powered with two engines and in tests has attained unusually high speed

RAILROAD WORKERS BUILD MODEL OF CRACK TRAIN

Working during their spare time, employees of the Santa Fe railroad at Topeka, Kan., have built a remarkable model of one of the line's crack trains. The locomotive is about five feet tall and

runs under the power of an old four-cylinder automobile motor. Actual smoke from burning oil comes from the smokestack to give the illusion of reality. Each coach is made of steel and electrically lighted.

The "train" runs upon rubber-tired wheels. In the dining car are tables with linen laid and each chair occupied by a doil diner. There is an observation car with brass railing at the rear and folding chairs on the platform. All seats are upholstered in plush, and leather covers

drawing room chairs.



PARKED CAR GUARDED BY ELECTRIC "FEELER"

AN INGENIOUS "electric feeler" guards a parked car while its owner is away, sounding the hom if a careless driver is backing into it. This curved metal arm with an electric switch at its base is mounted on the car's bumper about eighteen inches from the left end. A light touch on the arm is sufficient to close the switch and sound an alarm on the car's horn.



NON-SKID PADS CLAMP TO CAR'S PEDALS

EASILY and firmly attached to your car are rubber pedal pads that keep your feet from slipping off the clutch and brake controls. Sliding metal hooks on the back of each pad grasp the pedal securely when brought together by turning a connecting screw, much in the manner of attaching skates with a key, as demonstrated in the photograph below. The rubber surface of the pad is corrugated in a non-skid design.



Rubber non-skid pad that can be fastened to brake and clutch pedal by mere turn of screw

NEW AIRPLANE DOPE DEFIES BLOWTORCH IN TEST









Boiler and hot water heater are combined in the furnace two views of which are shown above At left is seen the exterior of the heating unit and at right, top of boiler with cover removed





soap and water, this brush, of rubber, does not injure the hands and cleans them thoroughly

BROILER TURNS ON GAS. When the handle of the broiler, left, is pushed down it puts the meat into cooking position and also turns on the gas and regulates the heat while the food is cooking



VERSATILE HANDLE. Long enough to reach the bottom of the tallest glass, this handle not only stirs but can be used to pull corks, open bottles, remove caps, and squeeze lemons or oranges

GLOVES PEEL POTATOES. Can-GLOVES PEEL POTATOES. Can-vas gloves, below, have palms covered with thin strips of twisted and stretched copper. When a potato is grasped and rubbed with a rolling motion between them the peel is removed. A bit of metal on one glove digs out eyes



Tools to Minimize Labor





ROAST CAN'T SLIP. Holding devices on this meat tray prevent roast from slipping while being carried or carved. A spring, in each grip, holds meat so carving can be done with one hand



WATER AND AIR FAN. Your room is cooled and moisture added to air with this electric fan. The fan is behind a reservoir of water agitated by a rubber belt so fan sends out a fine spray

BRISTLES AND RUBBER. Into this sponge rubber brush, bristles have been set so that it is really a combination bath brush and sponge. Bristles are so attached that they do not easily fall out



GLASS JAR
TOPS REMOVED. Heavy ridges
inside this rubber
ring are designed
to grasp top of a
glass jar of any
size and hold it so
firmly it can easily
be twisted loose



NO DUST IN CORNERS. Four-sided blocks, shaped to fit in stair corners, can be put in place and held with a drop of glue. They keep dust from gathering in the corners and make it easy to clean stairs. Once in place, they can be stained to match woodwork and add to appearance of stairs



AUTOMATIC DOOR HOOK. Screen doors are held shut with a hook that expands or contracts to allow for swelling or shrinking



YOU CAN'T LOSE THIS CAP. Quickly attached to tubes of dental or cold cream, this rubber cap is held to the tube by its rubber ring, and thus cannot be mislaid



LID AND KETTLE. A series of differentsized rims, in the bottom of this kettle, make it possible to use it on almost any saucepan. When placed on saucepan, it becomes a cover and at the same time water can be boiled in it by heat of cooking food



ning water with soap

EANER for jaws ongs that thur, this removing from the

HOLDS COLLAR BUTTONS. Ties are kept handy and in order on this novelty rack and in addition it carries, in a groove, the buttons for a man's shirt so they are never lost and cannot escape to hide under the bureau

Experiments with GAS

CARDBOARD

GLUED OVER

FLOWER POT

MEDICINE DROPPER

Simple Apparatus, Easily Arranged,

That Can Be Used to Demonstrate Industrially Valuable Properties of

Gases, Solids, and Common Solutions

JAR CON-

TAINING

OLIVE

BOTTLE

HYDROGEN

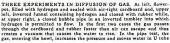
O YOU remember when, as a boy, you left your gas balloon pressing against the ceiling when you went to bed and the next day found it on the INVERTED floor, full of wrinkles and half deflated? And how you blamed the balloonman for not having tied the thread tightly? The truth is that no matter how tightly the thread was tied, the hydrogen would leak out through the rubber itself. Such a flow or escape of a gas is WATERcalled diffusion.

All around you, in hundreds of ways, this process of diffusion is going on. Millions of motorists, for example, wonder why their tires go down and have to be pumped every so

often, when there are no leaks in the tubes. Diffusion is the answer. Molecules of air are constantly finding their way through the maze of invisible pores in the rubber to join their relatives in the outside atmosphere.

Here is a way to demonstrate in a dramatic manner the effect of diffusion. Set up a hydrogen generator consisting of a test tube containing a lye solution into which some pieces of scrap aluminum have been dropped. Now take a small funnel made from the top of a bottle and over the large opening, fit tightly a piece over the large opening, it tightly a piece of thin balloon rubber, using rubber bands to hold it in place. Now hold the funnel rubber side up and push the delivery pipe from the hydrogen generator up into the funnel. Allow the gas to flow into the funnel until the air has





been forced down and out around the generator delivery pipe. Then quickly fit a cork, containing a piece of glass tubing, to the neck of the funnel and set up as

shown above, with the end of the tube immersed in a beaker of water. In a few seconds the water will begin to rise into the stem of the funnel.

This action is explained by the kinetic theory of gases which assumes that all molecules of gases are in motion. The molecules of hydrogen gas inside the funnel, being lighter and smaller, move out through the rubber faster than the heavier and larger air molecules can get in through the rubber, so a vacuum is formed within and water rises up the stem to equalize the pressure. Illuminating gas, which contains hydrogen, can be used instead of pure hydrogen gas.

A clay bubble pipe is porous and if the stem of the pipe is fitted with a glass U tube by means of a rubber tube, and mounted as shown at upper right, a still

more interesting experiment in diffusion can be performed. The bowl of the pipe must be closed by means of a tight-fitting stopper. Invert a tumbler over the bowl of the pipe and hold the end of a tube from which hydrogen or illuminating gas is issuing in the inverted tumbler. The gas will soon drive out the air. It will also go into the pipe by way of the invisible tiny holes in the clay.

MOLECULES of air within the bowl of the pipe are also coming out through the holes, but the hydrogen molecules get through so much faster that more hydrogen goes in than air comes out. This, of course, increases the pres-sure within the pipe and the water in the U tube is pushed over into the other arm. You may omit the U tube, if you prefer, and thrust the stem of the bubble pipe directly into water and note the bubbles coming from the end of the

If a miniature flowerpot is used instead of the bubble pipe, the surface available for the diffusion process is greatly increased. Enough pressure will be produced to force a stream of water through a medicine dropper. The flowerpot should be closed by cardboard, using wax. A stopper carrying a tube is fitted into the hole in the bottom and passes into an olive bottle as shown in diagram above. The apparatus should be tested for leaks by blowing into the medicine dropper. The experiment will fail if leaks are pres-

Liquids also diffuse, though more slowthan gas, and the speed varies with different solutions, as some simple experiments show. Fill two test tubes with water and into one drop some crystals of

Do You Know Your CHEMISTRY?

Before you read this article, see if you can answer correctly the following questions. The answers are given in the text on this and the next page.

- 1 How does air get out of a perfectly good auto tire?
- 2 What is this process called?
- 3 Will anything besides gas act in the same way?
- 4 What is meant by saturation and supersaturation?
- 5 Why does some dyed cloth change color on rainy days?

for the Home Laboratory



TO TEST AN ELECTROLYTE. With this apparatus it is easy to determine whether a chemical solution is a conductor of electricity. When acids, alkalies, or salts are dissolved in water, the resulting solution is an electrolyte, or conductor of electricity. If the electric lamp glows when the wires are inserted in a liquid, it is electrolytic

copper sulphate or nickel ammonium sulphate to produce a highly colored solution. In the second tube suspend the same kind of chemical in crystal form in a little copper wire basket so that it is at the top of the tube. The crystal in this second tube will dissolve and the solution formed will settle throughout the water in the test tube in perhaps a minute or two. If undisturbed, it may take several months for the solution in the first tube to become uniformly colored. At first the dense solution will stay at the bottom of the tube, but the colored solution will eventually diffuse throughout the entire test tube by the same process of molecular action that caused the novel effects with gas. Advantage can be taken of this experiment in dissolving quantities of crystals in water. Solution will be effected very quickly if the crystals are contained in a bag or suitable perforated metal or glass recep-tacle at the top of the water.

UST as some chemicals go into solution slowly if conditions are not favorable, it has been found that some chemicals come out of solution very rapidly.

If chemical solutions of salt, copper sul-

phate, sugar, or potassium nitrate are allowed to evaporate slowly, the substances dissolved will gather in large crystals. If the solutions are heated to hasten evaporation, small crystals are formed. In either case, when the solution is just about ready to crystallize, the solution is said to be saturated. If more of the crystals can be dissolved in a saturated solution without causing crystallization, the solution is said to be supersaturated, and then a slight jar or jolt will cause the whole solution to crystallize almost instantly.

In making carbon dioxide gas using marble chips and muriatic, or hydro-

chloric acid, the solution which re-

sults is calcium chloride. To make calcium chloride show the properties of supersaturation, heat it gently until a piece of marble in it no longer gives off carbon dioxide gas. Then remove the marble chip. Continue heating until a thick syrup is formed. Allow to cool to room temperature without disturbing the liquid. If the vessel is now gently twirled after cooling, the thick solution will immediately change to a solid mass of calcium chloride crystals.

The crystals will become exceedingly warm when this happens.

Practical use is made of this fact in some of the chemical heat bottles and bags. Crystals of photographer's hypo, sodium sulphate, sodium acetate, or ferric nitrate when heated without water in a flask or beaker become liquid, and finally syrupy. In this condition they can be made to crystallize out immediately by shaking or by adding a small crystal of the substance. In some cases the crystallization is slow, but fast enough to watch the crystals grow. Sometimes the growth is an inch a minute.

WHEN crystals are dissolved in water. the solution will exhibit a variety of properties. If the crystals or solid is an acid, an alkali, or a salt, which is the product formed by the reaction between an acid and an alkali, or base, then the solution formed in water always is a conductor of electricity, and is said to be ionized. A simple apparatus to distinguish electrolytes from nonelectrolytes can be made from a lamp, mounted on a board and connected to the house lighting system. Drawing and photograph above show the arrangement. The lamp will light when any conductor is placed across the two stiff copper wires, which are mounted

By Raymond B. Wailes



DISSOLVING CRYSTALS. If, into a test tube filled with water, crystals of chemicals are dropped, they diffuse very slowly through the water, often rehowever, the crystals are placed at uid, solution will be effected in one two minutes



EVAPORATING DISH

Drawing shows how to arrange an evaporating dish to be used in re-ducing saturated solution to syrupy condition

on the board and which can be dipped into a small vessel of solution to be examined.

Dipping the ends of the wires into solutions of copper sulphate, salt, potassium nitrate, acids, alkalies and similar chemicals will cause the lamp to light. Some solutions will cause only a faint glow. Use the same amount of substances and water when experimenting. Interesting tests can be made on alcohol, sugar solution, distilled water, vinegar, soft drinks, and also on dry salt or sugar.

AN IMPORTANT property of solutions is their strong tendency to remain in the liquid state. It is for this reason that solutions have higher boiling points and lower freezing points than the solvents from which they were made. Honey-a simple solution of sugar and other substances in water—for instance, may be exposed to the air almost indefinitely without evaporating, while water under the same conditions will soon disappear completely. Similarly, sea water, another solution, remains unfrozen while fresh water cooled to the same extent will become covered with ice. It is this property of solutions to remain in the liquid state that makes it possible for us to melt ice by sprinkling it with salt and to test milk for the addition of water by carefully determining its freezing point,

The parts of a mixture can often be separated by taking advantage of their difference in (Continued on page 86)

ELECTRIC CLOCK SPEEDS FARM AUCTION



ELECTRIC "clocks" are now used in Germany to speed up farm auctions. Wagonloads of produce are displayed. Then the buyers take their places in stalls, and the auction begins. As each load is put up for sale, the hand of the clock starts moving from 100 downward.

indicating the sale price. When the price is satisfactory to any buyer he pushes an electric button that stops the clock's hand. If the hand reaches too low a figure, the owner may push a button flashing the words "no sale."

FISH LIVES IN SEALED GLOBE

SEALED in an air-tight globe, a goldfish recently lived for three months at the North Dakota Agricultural College, at Fargo. Within the globe, water plants were fed by the carbon dioxide given off by the fish and produced



USE STEAM SHOVEL TO UPROOT TREES

DURING the building of a road near a Chesapeake Bay summer resort, the problem arose of removing a number of fair-sized trees. Ordinary methods of cutting them down and removing the stumps would have delayed the work, so the contractor used a powerful steam

shovel. With this he uprooted the trees bodily, to the delight of numerous spectators. Moreover, the holes left by the improvised treepuller were said to be smaller and to require less filling-in than ordinarily would have been the case.



Cash Prize WINNERS

in our July Heroes of Science Contest

Here Are the Names of Twenty-Nine Whose Skill and Application Brought Them Cash Rewards in Our Big Picture Cutting Contest in July Issue

FIRST PRIZE \$500

Earl Sargent. Atlanta, Georgia

SECOND PRIZE \$100

Elwin C. Leslie, Lakewood, Ohio

THIRD PRIZE \$50

Hester K. Sanford, Floral Park, N. Y.

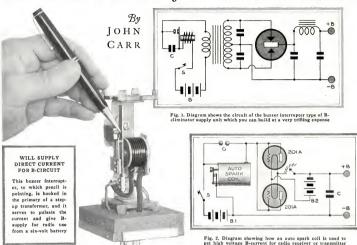
SIX \$25 PRIZES

Jean Allen, Washington, D. C. M. Chase Cooke, Los Angeles, Calif. Charles Held, West Toledo, Ohio Marye C. Hicks, Chicago, Ill. C. E. Madden, Fort Worth, Texas Charles W. North, Glenbrook, Conn.

TWENTY \$10 PRIZES

Elmer B. Benson, Moline, Ill. W. M. Boyle, Bakerstown, Pa. I. Caclaudie, Asbury Park, N. J. H. Castleberry, Legion, Texas A. F. Conron, New York City Albert E. Cooper, Philadelphia, Pa. Henry Dammeyer, Indianapolis, Ind. John H. Richardson, Ridgewood, N. Y. Jay A. Davis, St. Helena, Calif. Lela Engle, South Bend, Ind. David Felzer, Wankegan, Ill. R. Geller, Pittsfield, Mass. C. W. Glenn, Jackson, Michigan Charles Gray, Brooklyn, N. Y. John L. Moore, Ortega, Fla. Bryan Hadley, Clayton, Ind. A. G. Kalmbach, Grand Rapids, Mich. Charles H. Kuhn, Indianapolis, Ind. Ethel Millspaugh, Anderson, Ind. John Perry, Glen Lock, Pa.

B-current for Your Radio



N SECTIONS remote from electric power lines, the radio experimenter is confronted with the question of how to get an adequate supply of high voltage, filtered direct current for B-circuit use.

filtered direct current for B-circuit use.
The most obvious solution is heavy
duty, dry cell B-batteries, but there are
other ways to get high voltage direct
current that can be filtered or smoothed
out for radio B-service on receiver or

transmitter.

There is, for example, the small dynamotor set that draws six-volt current from a storage battery and generates a supply of current at 180 volts (P.S.M., July '32, P. 63). This unit, including the necessary filter circuit, is complete in one small case. For automobile use, where the storage battery is kept charged by the car's generator, the dynamotor is excellent. Also, it can be used on farms equipped with thirty-two-volt lighting

3-Nationer new form of B-supply, designed to run on a six-volt storage battery, employs a buzzer circuit breaker in
connection with a step-up transformer
and a rectifier tube. It will prove practical in any service where the dynamotor
unit can be used to advantage. The buzzer
circuit breaker is shown in photograph
above, removed from its sponge rubber
limed case. The heavy sponge rubber
limed case. The heavy sponge rubber limed case.

ing is needed to mufile the mechanical sound of the vibrator.

The vibrator interrupter or buzzer breaker type of B-supply circuit is shown in theoretical form in Fig. 1. It works because an interrupted or pulsating direct current has about the same effect on an alternating current transformer as does real alternating current, provided the rate of pulsation roughly corresponds to the frequency for which the transformer is designed.

The rate of make and break can be regulated by the length and stiffness of the steel spring armature. Condenser C is important because, without it, the breaker points would soon burn away. It should have a value from one-half to one microfarad. The set-up transformer must be specially wound, as the power transformers usually available have a primary adapted to one-hundred-and-ten-volt supply, and would not be usable on six-volt current unless rewound.

Another way to obtain high voltage Bcurrent from ow voltage direct me. Another way to obtain high voltage and another with the state of the state

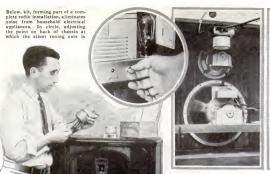
everything connected with the tubes is at high voltage with respect to the other battery, B-1, and the minus B side of the

The B-supply systems of both Figs. 1 and 2 should be particularly interesting to amateur radio operators who live where no electric light current is available.

Either system can be used with a low-power radio transmitter. The interrupter operated B-supply of Fig. 1 is technically more desirable because it will give a more satisfactory output and is more economical of current. The chief difficulty with the spark coil is not well adapted to this work. The secondary is wound with many turns of fine wire and the secondary output develops several thousand volts more than you need. This excess voltage is wasted, Spark gap G should be set so close that any sudden voltage surge will cause current to flow across the gap and thus save the tubes from overloading.

A gaseous type rectifier tube is shown in Fig. 1. It is possible to use such a tube in place of the two 201A tubes in Fig. 2 and thus save the use of the extra battery.

For a small portable transmitter, the spark coil can be operated with flashlight cells and the current rectified with a gaseous tube. This will reduce both the cost and weight (Continued on page 98)





A flick of this button throws off the automatic silent tuning control when you want to go after distance

New RADIO SETS Tune

the set end of the new double shield-

F YOU have never turned the tuning knoh on one of this season's radio receivers, you have a new sensation

coming to you!

Last month I discussed the various circuit improvements of the latest sets. They are important, because they insure hetter radio performance, but they seem almost insignificant when compared with the strides made in radio control. In this respect, radio has closely paralleled the development of the automobile. Where formerly we had to crank the engine and learn all sorts of tricks in order to change starting, silent shifting, free-wheeling, and other features that take all the hard work out of auto driving.

Now, in radio, we have automatic volume control, automatic tone control, visual tuning, manual silent tuning, automatic silent tuning, noise elimination, and other features to make the radio receiver so easy to handle that even a baby can tune the set and tune it right.

If you have a radio set that is more than two years old, you know that when you tune through the broadcast range, one station may come in with a roast range, one station may come in with a roast that nearly splits your eardrums and the next may be nothing but a faint whisper, will be the steady, snanoing and sparing of static.

steady snapping and snarling of static. With any old-time set, this result is inevitable. The intensity of the signal from different broadcasting stations, even semi-local ones, may vary as much as one to a hundred thousand or more at your antenna. No matter how you set the ordinary hand volume control, you can never hope to get more than one or two stations at the right volume without readjusting.

Automatic volume control, on which many of the other new features depend, has heen experimented with for several years. Last year it became an accepted feature, although it was not fitted to all sests nor did it function any too well on some of the sets that had it. There are various methods of obtaining automatic volume control. All work on the principle of using the strength of the incoming carrier wave to vary the sensitiveness of the radio or intermediate frequency amplifier stages of the receiver. The stronger the incoming carrier wave, the less the receiver amplifies, and the weaker the incoming wave, the stronger than the wave, the stronger than the wave, the stronger than the stronger than the wave, the stronger than the stronger than the wave, the stronger than the str

In theory, this system should hring in all stations within the local and semilocal range of the set at precisely the same volume. It is not quite that nearly perfect, however, hecause there are differences in the degree of carrier modulation-that is, in the ratio of carrier wave to sound vihration strength. This variation is rapidly hecoming less and less as the weaker stations improve their equipment. In any case it is not likely to be greater than one to four, comparing the best equipped station with the worst heard in any given locality. A change of volume in the ratio of one to four seems trifling to the human ear and amounts to nothing as compared with the tremendous variation found in sets without automatic volume control.

WITH such an arrangement, it is obvious that the set is operating at
maximum sensitiveness when no signal is
maximum sensitiveness when no signal is
maximum sensitiveness when no signal is
deafening roar of static at points in between stations. In early models incorporating automatic volume control, a hutton
was provided to cut out the loudspeaker while tuning. Now we have automatic
silent tuning. You hear nothing at all
between stations. The sensation of tuning
a modern set seems almost weird to the

old-time fan accustomed to roaring static

and any old volume level.

The method by which the static between stations is choked off is extremely ingenious. The carrier wave is utilized to operate either a mechanical relay or an electrical equivalent of it, which cuts out the speaker or 'kills' the automatic amplifier end of the set when the carrier wave strength falls below a certain minimum. This minimum can be adjusted, usually hy a separate small knoh at the can be heard through the normal static level will cut in or "turn on" the amplifier or speaker.

THIS combination of automatic volume control with automatic silent tuning (sometimes slightly different terms are used to designate these functions) is ideal for the average radio user who wants maximum entertainment with minimum trouble.

It does not, however, suit the ardent radio fan who likes, now and then, to go hunting for distant stations. It would be inconvenient if you had to adjust the silent tuning control on the hack of the set each time you wanted maximum sensitivity for distance fishing, so a simple throw switch on the front panel, or some equivalent set-up, is supplied. This permits cutting in or out the silent tuning hy a flick of the finger. Minus the silent tuning hut with the automatic volume control still on the job, the set becomes ideal for going after the laraway weak stations. You get no thunderous roar when you happen to pass through the setting for a powerful local station.

In some of the simpler sets, manual

In some of the simpler sets, manual silent tuning is employed instead of the more elaborate automatic variety. In these less expensive models, a button must be



View of the automatic control that governs volume. A tiny year on the end of the control shaft moves the special resistance contact arm to change the set's tone quality to fit the human ear

Themselves

pressed while you are tuning to get the silent effect between stations.

Visual tuning, which substitutes an accurate setting by eye for the uncertain and usually inaccurate tuning by ear, is now a feature of about seventy percent of the new receivers. Several makes of sets use the climbing neon light which shows by the height of the red glow when the set is precisely in tune. Others use various forms of meters, the position of the indicator giving the same information.

Automatic tone control, also called tone compensation and other names, is incorporated in some of the latest receivers.

It has been known for some time that tone reproduction approaching theoretical perfection does not sound exactly right to the human ear unless the volume from the speaker equals the volume actually produced in the broadcasting studio. At anything less than studio volume, the effect on the ear is as though a soft pedal had been applied both to the higher frequencies that make speech understandable, and to the lower frequencies that form the

There are few occasions when the radio user wants studio volume in the home, and as a result the best old-time sets were, in effect, giving distorted reproduction most of the time.

AUTOMATIC tone control compensates for deficiencies in the human ear. When you turn down the volume on a set having this feature, the relative strength of both the top and the bottom of the tone scale are increased with respect to the middle register. The volume control knob on the front of the receiver therefore turns, in addition to the volume level potentiometer, a switching or resistance arrangement that produces the desired change in tone characteristics.

Knob Twisting to Get Right Volume and Tone Is Unnecessary with This Year's Noise-Eliminating Receivers



Left, turning this knob on one of the latest sets

Bv

does double duty, as it changes the volume and tone

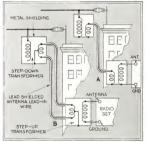
Below, diagram of new antenna systems to eliminate noise trical apparatus

The elimination of unwanted noise in radio reception always has been the goal of radio engineers. So far, no way has been found to get rid of natural static except to increase the strength of the broadcasting, This has been done to the point where local and semi-local stations give satisfactorily noisefree results from your speaker. This is unfortunately not true with regard to man-made static. the noise forced out of your speaker by a thousand and one types of small household electrical appliances.

T HAS been known for several years that a high, and relatively long, outdoor antenna brings in more broadcasting, with relation to the man-made static picked up by the lead-in

and the set itself, than does a short indoor or loop antenna. That is why the loop has disappeared and the indoor antenna is used only when unavoidable. Carefully shielding the set and using a shielded lead-in helps, but the shielded lead-in defeats its purpose by cutting down the strength of the radio impulses.

A way around this trouble has been found and we now have systems that cut out nearly all the man-made static. The diagram shows variations of the latest thing in noise elimination. In operation. a high-frequency, step-down transformer attached to the antenna feeds the radio signals down the shielded wire at much lower voltage. At the set, they are stepped up to the original voltage by another high frequency transformer. The secret lies in



the fact that the losses due to capacity in a shielded lead-in are far less at lower voltage.

The double shielded lead-in system has the advantage of center-tapped low voltage windings. This halves the effective voltage with respect to the shielding. A system like this is sold only as part of a complete radio installation.

AS A result of all these changes and improvements, the sets this fall are more selective than ever, with a more faithful reproduction of tone quality. However, their most distinctive feature, probably, is the ease with which they are manipu-lated—a characteristic that will make a strong appeal to the vast majority of radio broadcast listeners.

How Car's Ammeter Can Warn of

Ignition Trouble

By MARTIN BUNN

ANT to make a million dollars? Gus Wilson, veteran auto mechanic and half owner of the Model Garage, pulled his head from under the hood of the car on which he was working.
"Hello, Pete," he said. "What's

the big idea now?"

Pete Dilbow glanced furtively about over the tops of his spectacles. "You're going to be out of a job soon!" he announced impressively, "All these cars are obsolete. They'll go straight to the junk pile soon as I get some of the little details of my latest invention worked out. It's a new kind of automobile that doesn't use gasoline. I thought, since you're in this business, maybe you'd go in with me for about a tenth share. That would bring

you at least a million and maybe ten times that much, if we're lucky."

Gus had been offered shares in Pete's

inventions many times, but nothing had ever come of any of them.

"Sounds important, Pete," Gus told him. "Tell me about it."

At that Dilbow drew out a neatly folded sheet of brown paper and spread it out in front of Gus.

"Here," he explained, "is the design of a new kind of automobile. Learning how an ordinary car works. I had a wonderful idea. Instead of using a little motor to start the engine, I put in a motor big enough to run the car, then I put in a big generator or dynamo and a large size storage battery. The current from the battery runs the car and the dynamo keeps

the battery charged. What could be simpler than that?" "Sure is one grand idea, Pete," Gus



"It's a new kind of automobile that doesn't use gasoline. It would bring you in at least a million," Dilbow explained, "Sounds important," Gus said, "Tell me about it."

chuckled. "There's only one trouble with it. It won't work."

"I'd like to know why not," Dilbow

demanded. 'Well," Gus explained, "if it did work,

that would be perpetual motion, and there isn't any such thing."

"Wouldn't this motor drive the car?" Dilbow asked.

"Certainly," Gus agreed. "Until the

battery ran down if there weren't any-thing else to stop it." "Wouldn't this dynamo charge the bat-

tery?" Dilbow insisted.
"It surely would if you kept it spinning at the right speed," Gus admitted.

"Then," snapped Dilbow, "what do you mean by saying the idea won't work?

"For the simple reason," Gus explained, "that electric energy is just like water power or steam power or any other kind of power. It takes more power to pump water up hill into a tank

than you can get back again by letting the water run down through a turbine.

"What do you think would happen if you made an auto like that drawing? When you turned on the juice, the car would start because current would flow through the motor, but if you put in a dynamo or generator big enough to make as much current as the motor uses, it would take more power to drive it than the motor would produce. The car would start all right, but the minute the generator cut in, it would stop as though you'd slammed on the brakes.'

"If that's so," Dilbow interrupted, "then how do they get away with such small generators on automobiles? Isn't that generator," he added, pointing to the one in the car on which Gus had been working, "as small as the self-starter and doesn't the self-starter motor have power enough to turn over both the engine and the generator at the same time? And doesn't it keep the battery charged?" "Listen, mister," Gus said, "you can't

judge a book by its cover. And you can't judge how much power a generator will take or a motor will give by its size.

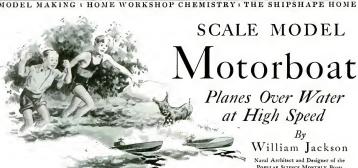
"The self-starter motor on a car is a specialized job. It has to develop as much as a half horse power or more for just a few seconds of time and it has to do it on only six volts of electrical pressure. To get that result, the armature is wound with solid copper bars and the field with a few turns of heavy copper ribbon. Then there are four copper brushes with a wide commutator. When you press the starter button, the juice flows through the starter motor in a regular flood. Maybe as much as three or four hundred amperes go shooting through the starter motor windings for the fraction of a second it takes to 'break loose' a cold engine. Even after the crankshaft starts to turn, maybe seventy-five to a hundred and fifty amperes keep on flowing until the ignition takes hold. No starter motor could stand that load for long. The only (Continued on page 100)

GUS says:

Because a spark plug has fine insulation, clean cut threads, and ample spark points, it does not follow that it will give even fair results in your car. What counts is the design of the plug. Some plugs are made to run hot, others medium, some cold. Put a cold running plug in a cold running motor and it's sure to foul if there's the least bit of excess oil. Put a hot running plug in a hot running motor and you get pre-ignition knocks. Sometimes if the cylinder and rings are in good shape, plug fouling is cured with a hotter running plug. BETTER SHOP METHODS: IDEAS FOR THE HANDY MAN: BLUEPRINTS

THE HOME WO

MODEL MAKING: HOME WORKSHOP CHEMISTRY: THE SHIPSHAPE HOME



RIVEN by three sets of rubber bands, this little motorboat hull-a scale model of the POPULAR SCIENCE MONTHLY Vagabond-attains an astonishing speed. It planes on top of the water exactly like a large speed boat and skims along for more than 100 ft.

When powered by a spring-operated toy model of an outboard motor such as that shown in the illustration at the right, it will run about 200 ft. at a speed of from 4 to 5 miles an hour.

The hull is a 1/8-in. scale model of the 13-ft. Vagabond, a combination rowboatmotorboat that many readers have built with great success (P. S. M., Mar. '32, p. 75, and Apr. '32, p. 82). The over-all length is 19 11/16 in., the extreme beam 63/4 in., and the weight 81/2 oz. If a rubber band motor is used, either two or three sets are required, and these should consist of seven strands each.

The framework should be constructed of spruce, and for the planking material use clear 1/32-in. white pine, cedar, or mahogany. The bottom may be pine or cedar, and the sides and deck mahogany.

Draw full size paper patterns of the frames, transom, and stem; then mark and saw out the frame parts. Lay the frame material on the patterns so as to conform to the outline, and glue together with waterproof casein glue or a quick drying nitrate base cement.

The completed frames are next notched for the keel, chines, and inwale. The stem



This trim looking, speedy little model is slightly less than 20 in, long and 6¾ in, in extreme beam. It weighs only 8½ oz. and may be driven by a toy outboard motor or by rubber bands

is glued and attached to the keel with two 1/2-in. brads. Mark on the keel the correct spacing for the frames.

It is necessary to make a form on which to assemble the framework. This form is shown at the bottom of the drawings on page 62. When it has been set up in a convenient place to work, fasten the keel temporarily to it. The various frames are then glued and fastened from the inside to the keel with one 1/2-in, brad to each frame. Be sure to level and line the frames up before the glue sets.

Starting at the transom, glue and nail the chines to the frames. Drill lead holes for the brads. Fasten the chines on both sides simultaneously. Spring clothespins make excellent clamps to hold the parts in place until the glue dries. Tie the chines together at the stem until the glue is thoroughly set.

oughly set.

The inwales are next glued to the frames, but make sure first that the frames are properly lined up. The after and forward ends of the inwales are glued

and nailed with 1/2-in. brads.

The forward motor hook is bent to shape from 1/16-in, brass rod. Drill the stem and insert the hook as near the top of the stem as possible. Embed the out-

HOW TO CONSTRUCT OUR "VAGABOND" IN MINIATURE

Deck seams may be simulated by cutting sheer plate. side of the hook firmly into the stem. Glue the deck beams in place, and tem-

porarily set small wood strips between frames Nos. 4 to 8 so as to prevent undue strain on the frame joints when the planking is applied. The corner brace or knee and the inside coaming are now glued in position.

The planking on the original full size

boat was divided into three strakes on each side, and eight strakes on the bottom. To simplify matters, the model is constructed with one 1/32 by 1/4-in. batten on each side, and two battens of the same size on the bottom. These are carefully notched into the frames and glued.

The side planks are each attached in one piece, but the bottom planks in four pieces. While the 1/32-in. planking is thin enough to bend easily, it is best to soak the pieces in hot water and bend to the required shape as accurately as possible by hand. When dry, glue the planking to the framework.

Plank the sides first; then remove the

hull from the form and carefully trim the projecting edges flush.

The upper view was snapped when the model was speeding along under the power of its rubberband motor. The other photograph shows the framing. Note the batten for the side planking

On the bottom begin by gluing the two planks nearest the keel. These are cut to shape so that the seams will meet in the center of the bottom battens. Soak the bottom planks in hot water and shape them by hand before gluing.

Fill any defective spots in the seams with a plastic wood composition. Sand the hull smooth and apply two or three coats of varnish or lacquer inside.

Glue the 1/32-in, decking to the deck in two pieces, with the seam in the center.

faint lines in the deck about 3/8 in, apart. With the decking in place, glue the

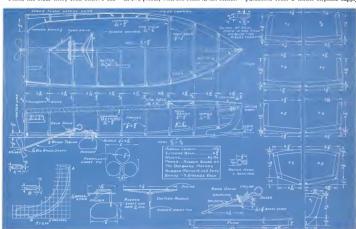
1/32-in. coaming, end piece, and sheer plate in position. Allow 1/8 in. of the coaming and end piece to project above the

Moldings 1/32 by 1/8 in. are glued to the sheer to give a finished appearance to the hull and make it look shipshape,

A false outer bow stem 1/16 by 1/8 in. is soaked in water and bent to shape so as to fit the outer edge of the bow. This piece covers the bow and the edges of the planking at this point.

Paint the hull below the water line bright green, and make the 1/8-in. boottopping white, striping it on as neatly as possible. The remainder of the hull is then varnished. Rub with fine sandpaper between coats.

The gear drive is built as indicated on the plans, or the gear assembly may be purchased from a model airplane supply



orking drawings for a 1/2-in, scale model of the 13-ft. Vagabond, one of Popular Science Monthly's best known outboard motorboats, Complete working drawings for a 32-in, scale model of the 13-it. Vagacona, one of replied "science" monitary's dest known outcoard introduction. The frames should be laid out full size on paper so that the parts can be cust and assembled accurately. The gear drive can be bought, if desired

FRAMED AND PLANKED EXACTLY LIKE THE ORIGINAL





The underside of the hull showing propeller and rudder and, at left, the gears and rudder control from above. Compare with the details on page 62

house. The gear assembly is fastened to the keel with one 5/16 by ½ in. machine bolt. The rudder assembly is similarly bolted with one ½ by ½ in. machine bolt. By studying the draw-

By studying the drawings carefully and doing the work with painstaking attention to every detail, you can learn a good deal about boat building as you construct this little model. In fact, as you progress with the assembling, you will find that it follows closely that of the full size *Vagabond*. Indeed, the operations are essentially the same, only on a larger scale.

You will find it interesting to look up the March and April, 1932 numbers of POPULAR SCIENCE MONTHLY, if you keep a file of back issues as so many home workshop enthusiasts do. The photographs on page 77 of the March issue will show you how the framework for the full size boat was set up, and the illustrations which are shown in the April issue will give you a good idea of the method of planking the hull.

Space-Saving Table and China Closet for Small Kitchen

For small apartments or where space is limited, this combination kitchen china cabinet and breakfast table will find favor. It was made of 13/16-in, clear white pine in a home

workshop where the only special machine was a jig saw. The dimensions of the cabinet itself—the box part fastened to the wall—are 12½ by 30 by 36 in.; and the door of the cabinet, which forms the table when let down, is 30 by 35 in. The back is a sheet of ½4-in. plywood, screwed securely to the frame and shelves. The cabinet is fastened directly to the wall 29 in. from the floor, giving the right table height.

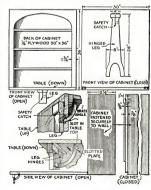
The catch used is of my own invention and serves both as safety of the catch of the

whereupon it slides into the slot through the table. The table is raised to a vertical position against cabinet, but the end of the leg is held away from the top a few inches. Then, when the table is against the cabinet the leg is pushed against the underside of the table top, thus locking the cabinet and drawing the top tightly into place to

serve as the cabinet door. This hooking arrangement, which is entirely out of sight, is a puzzle to the uninitiated.

The inside is orange enamel; the shelves, table, and outside are a light green enamel; and the edges of the shelves, table, and table leg, black enamel. If desired, the top of the table could be stenciled or decorated with transfers.—A. C. JOHNSON.





Bench and Tools Hidden in Carved Cabinet





The folded top is stored away inside the center compartment of the cabinet. Below: Drawings of the top and a suggestion for making the ornamental door panels

FOR use in an apartment or wherever space is restricted, a unique, compact substitute for a workshop can be made by adding a folding bench top to a tool cabinet of standard design such as has been described before in POPULAR SCENCE MONTHLY, With a little extra work the whole cabinet can be given the appearance of a decorative piece of furniture.

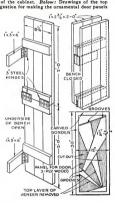
The bench top, which is 8½ in, wide and 48 in, long when open, is sufficiently large for the average job done in the home. When folded, it can be stored in the cabinet. Each half of the top is made of three pieces of 1 by 23½ by 24 in, white pine fastened with cleats, as indicated in the accompanying drawings. The two halves are joined by means of two heavy 3-in, steel hinges. Two cleats 6-in. long are hinged to the front for fastening the bench top to the cabinet doors with clamps as shown in one of the photographs. If preferred, the bench could be attached to the

The cabinet itself is of oak. To make it more ornamental, additional panels of thin three-ply wood were cut out as in one of the drawings and glued on the doors to give a carved effect. To set back some of the converging rays, certain parts of the panel, it will be seen, were cut away entirely with a scroll saw. Geometric designs were then carved around the 11/4 in, wide borders of the panels, and the top layer of veneer was shaved away from all the remaining surface within the borders, giving a distinctly hand carved effect of a rugged or antique type. The top and sides of the cabinet were further decorated by cutting well-spaced lengthwise grooves.

top of the doors with bolts and wing nuts.

When the cabinet was ready for painting, an effect of light and shadow was obtained by rubbing off much of the stain on the higher parts.

One of the photographs shows the finished cabinet closed, with a model of the Popular Science Monthly Viking ship on top.—Carl Julian Vetter.



Our BLUEPRINTS Insure Success

BEFORE you begin to build any project whatever in your home workshop—whether it is something described in this issue or not—look up the list on age 80 to see if blueprints are available. If they are, take advantage of them.

Our blueprints cover many subjects, and they are all large, clear drawings so carefully detailed that it is a pleasure to use them. In many cases the parts are shown full size.

The drawings that appear in the magazine have to be sharply reduced both in size and number to fit the limited space available. For actual use at the bench, therefore, our blueprints are much superior. They will do more than any other one thing to insure your success.

STAND SUPPORTS MAGNIFYING GLASS



The magnifying-glass stand in use and, at right, a sketch of the simple clamping device

THIS stand was designed to support an ordinary magnifying glass steadily and at the correct height for viewing any small object. It is also an aid in taking photos through the magnifier.

No changes are made in the glass or its handle, and it may be removed in a second's time. A piece of tubing or pipe 2 in, long and with an inside diameter equal to the diameter of the glass handle is used to hold the instrument. A 3½-in, hole is drilled through the tube near one end to side on the 4½-in, vertical rod, and a set



screw holds it at any height desired. Another set screw secures the handle of the instrument in the tube. The base can be made up of junk-box parts in any way desired.—W. C. WILHITE.

DISTINCTLY novel in design. this night lamp resembles a miniature lighthouse, and when it is picked up a homemade automatic switch in the base causes it to light. To make one like it requires only an inexpensive pocket flasb light, a tin plate,

and a few other small parts. Obtain a flash light using the smallest size dry cell. Make over the bulb end as shown in the accompanying drawing by cutting off the top, soldering on a washerlike copper disk, and soldering the socket into the disk. Cut a hole in the bottom of the flashlight case and install an automatic switch made as sbown. The 1/8 in. thick disk of hard fiber should be just large enough

to fit in the base of the flash light, while the round brass spring should clear the edge of the cut-out hole by 1/32 in. when riveted in place. Remove the side switch regularly furnished. If the flash light has a fiber tube, solder a copper wire or strip connection between the top and the bot-

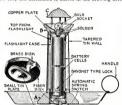
tom metal parts.

The wooden parts, A, B, and C, can be made easily in a lathe, or they can be shaped without difficulty from pine with a sharp knife and a file. The supports for the roof are firmly set in part C, but make a sliding fit in the holes in part B so the roof may be removed to change the bulb.

A round hole is cut in the 6-in, tin pie pan or plate for the switch spring to pass through, and a ½ in. wide handle is sol-dered on. The part A is then attached with brads.

For the "walls" of the lighthouse, prepare a very slightly tapered cone of tin and trim the shoulders of the wood parts to fit. This part can best be made by first

This Little Night Lamp Lights When Lifted pocket flash light having the smallest size cells is the painted tin walls of this lighthouse 23 The lamp, the automatic switch, the outer casing, and the top. How they are assembled is shown in the drawing below



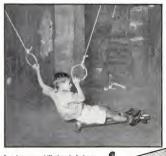
whittling or turning a tapered wood form and cutting a piece of lightweight tin to fit around it exactly, the edges meeting in a butt joint. Wire the tin around the form, solder the joint, and file off the excess solder and wire. The tin may then be slipped off the wooden form. Brad the top of this tin casing securely in place, but key the bottom with a fastening of the bayonet socket type, as indicated, so the cells will be accessible for changing them.

An inexpensive

Assemble the parts and adjust the spring so that the weight of the lamp will break the contact it makes with the rim of the metal piece at the bottom of the flashlight case and thus put out the light. When the lamp is picked up, the spring again makes contact and completes the circuit through the dry cells and bulb.

Paint the casing white and the base and other wooden parts green or brown. windows and doors are painted with black enamel, while the tin plate with its handle are given two coats of copper colored "bronze" paint. If a small quantity of luminous paint can be obtained from a jeweler or watch manufacturer, a little may be applied near the handle to make the lamp easy to locate at night .- E. A.

SKATE TRAPEZE GIVES BOYS EXERCISE



It takes more skill than it looks to It takes more skill than it looks to operate this amusing exerciser, but an occasional spill only adds to the zest. The boy who thought of this device is the eight-pear-old son of J. G. Pratt, of Washington, D. C. regular contributor and one of the greatest experts on photomicrography

THIS muscle building and fun giving pastime requires merely a "skatemobile," minus the pro-verbial soapbox, and a couple of hand rings suspended from the floor beams in the basement. Seat and foot rests are attached to the coaster. The game consists in sliding the coaster backward and forward rapidly from one ring, and then catching the other ring and repeating the whole operation.-REEVE PRATT.



REMOVING ODORS FROM A VACUUM BOTTLE

After it has been thoroughly washed, bottle of the vacuum type for keeping liquids hot or cold can be freed from any slight sour odor that remains by dropping one or two crystals of potassium perman-ganate into it. By oxidation, the crystals will "sweeten" the bottle, but it should be washed again before being used .- R.B.W.



WO life-size black cats with backs arched and tails raised in true Halloween fashion form the sides of this novel jig-sawed rocker for a child's playroom or nursery. Designed for a four- or five-year-old child, the chair is 20½ in, high and 12¾ in, wide over all. However, the same design can be used within reasonable limits for a larger chair

simply by increasing the dimensions. In constructing the chair, the writer used 1/2-in, five-ply wood for the sides and seat and a piece of 3/4-in. solid stock for the back, but 3/8- or 1/2-in. plywood can be used throughout, if desired. If solid stock is used for the back, plan the outline so the grain runs crosswise.

First, lay out full size 4-in. squares on a large sheet of wrapping paper and sketch in the outlines of the cat, cat's head, and seat according to the drawings below. Transfer the enlarged outline of the cat

Here is a rocker that will appeal to the imagination of any little boy or girl because it has a picturesque, story-book quality. It can easily be made on a small power scroll saw

to one piece of plywood, place this on top of the stock for the other side, and drive thin brads in the scrap areas to hold the two

pieces together. By doing this, both cats can be sawed out in a single operation.

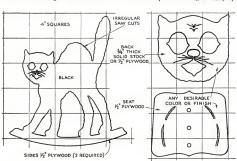
When all the outlines have been transferred to the stock, drill holes in the inside scrap to take the saw blade for the start of each cut. In sawing the outlines of the sides and back, shift the work slowly from one side to the other to give the finished pieces an irregular furry appearance. The whiskers on each cat can be formed by making single-width cuts.

In making a small chair of this type, sufficient strength can be obtained if it is assembled with glue, screws, and four angles-the screws being used to hold the back in place and the angles being used to support the seat. If mortise and tenon construction is desired, allowance for two tenons on each side of the back and seat should be made when cutting the stock, Since a tight fit is important, make the tenons slightly large at first and then trim them to fit the mortises cut in the sides.

With the exception of the two cats, which look best painted black, the question of finishing is a matter of personal preference. In contrast to the black sides, the writer found a red back and seat to be effective. Two coats of paint, one before assembling the parts and one after, will prove sufficient

HOW TO GIVE WOODWORK A CRACKLE FINISH A COLORED "crackle" finish similar to

that found on some metal cameras can be given to wood by applying a concentrated water solution of magnesium sulphate to which coloring material and sufficient dextrine to give it the consistency of varnish have been added. The solution is spread on with a brush and on drying forms into beautiful crystals. If the wood is extremely porous, it should first be given a coat of glue size.-K. M.



To prepare full size patterns for the parts, lay out two groups of 4-in. squares on a large sheet of wrapping paper as shown above and copy the three designs carefully, square by square

COSTLY LOOKING

Modern Book Ends and LAMP

Made from Copper and Brass



These unique book ends and the equally distinctive lamp are an example of what can be done in the home workshop with inexpensive materials. The end table, too, is homemade

AKEN in the plain form in which they come from the mill, ordinary copper and brass plates, bars, and sheets lend themselves readily to the fabrication of articles of modern design

with a minimum of cutting and shaping. The pair of book ends illustrated are each made of three flat plates and three bars. The bottom plate is 1/8 by 3 by 41/2

in.: the plate resting on the bottom is 1/16 by 134 by 3 in.; and the vertical plate is 1/16 by 3 by 33/4 in. The bars are all 3/16 by 13/8 by

5 13/16 in. First cut the parts with a hack saw, file the edges (rounding the top of the bars as shown), and smooth them with emery cloth. Ap-ply a spot of solder on each of the two bottom plates, lay one on the other, and set them over a gas flame. When they are fused to-gether, cool them with a wet cloth. "Tin" the edges of the base and vertical piece and then hold them carefully in position with pliers while soldering. Care must be taken that the first joint

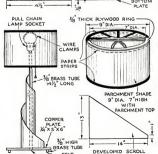
is not loosened. The three vertical pillars can be attached with solder or machine screws as desired. If solder is used, first thoroughly clean all parts, then tin the joining edges of the pillars and apply flux to the bottom and vertical plates. Next place the parts and hold them over the gas flame, handling them with pliers and a wet cloth as shown in one of the accompanying photographs. If machine screws are used, the holes in the pillars can be tapped to take the screws,

or the screws can be made to cut their

The lamp may be either copper or brass. The center brass tube can be obtained at an electrical supply house with a thread

own threads by forcing them into holes drilled slightly smaller than the outside diameter of the threads. Polish all surfaces with emery cloth, rubbing in one direction only.

TVERTICAL DIATES воттом PLATE PULL CHAIN 3/8 THICK PLYWOOD RING -LAMP SOCKET 9" DIA.



-FELT

THICK COPPER

HOLE TO FIT TUBE

EVERETT EAMES

cut on one or both ends. First solder four small pieces of tubing to the base plate; then solder the tube into a drilled hole in the base, testing with a square to make sure that it is vertical.

The metal scroll is cut as shown from soft copper or brass sheet about .025 in. thick. Roll it around a broom handle and then unroll slightly to obtain the effect illustrated. The scroll should be soldered at the top to the center tube,

A pull-chain lamp socket should be screwed to the center tube, and a lamp cord passed through the tube. The short legs should be filled with wood composi-

tion and have felt cushions glued on. The shade is of special design to harmonize. It should be made of plain, mottled yellow parchment paper obtainable in stationery stores. Cut out the plywood ring and to it attach a bulb holder from an old shade. Tack the parchment to the ring and fasten the ends together with rivets made from small pieces of copper wire. Tack a disk of the paper to the top, and trim with strips of black paper.

The completed standard should be well polished and coated with clear lacquer.



Small clamps hold the scroll to the central pipe of the lamp while the joint is soldered

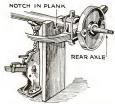


How the book end parts are held in position over the flame with pliers and a damp cloth

Timely Hints for Car Mechanics

Locking Brace for Brake Pedal

W_HEN one wheel has been removed for repairs, a car can't slip of the port illustrated below is placed beneath the axle. This support consists of a length of heavy plank or two by four notched at its upper end to receive the axle. The length of the support is determined by the distance from the ground to the axle when the wheel runs free.



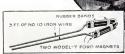
A heavy piece of plank with a notch cut in the end makes a safety support when wheel is off

Brake Pedal Brace

AN ADJUSTABLE, self-locking brace made from a piece of one-half-inch-diameter steel rod, a length of seven-eighths-inch diameter steel pipe, and a to hold the brake pedal in any desired position while adjustments are made to the brake rods or drums. A fourteen-inch rod and a twelve inch long pipe have been found suitable for the average car. In use, the brake pedal is pushed down and the square end of the pipe rested against the top of the pedal. The steel rod is then the hase of the driver's seat and the washer is pressed against the washer is pressed against the washer is pressed against the angle at the end of the pipe.



Self-locking brace to hold brake pedal during adjustment is made of steel rod, pipe, and washer



Using Old Magnets

TWO discarded Ford magnets, supplied with wire pole extensions in the manner illustrated, form a valuable tool for retrieving small parts that drop into hard-to-get-at places around a motor. The magnetized extensions can be alipped into small openings without difficulty. A better job can be had by binding the extensions to all the placed in the placed in the placed around the placed arou



Grinding the ends of plier jaws to sharp curve permits use on corroded cable clamp

Better Pliers

PLIERS used to adjust storage battery cable clamps that have become corroded can be greatly improved by grinding the ends of the jaws to a sharp curve as shown above. Altered in this manner, they can be forced down over the nuts with little difficulty and the teeth will get a good grin.

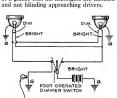
A Dimmer Guide

WHEN driving an automobile equipped with a foot-operated dimmer switch, it is often difficult, especially when a car is approaching you, to determine whether the headlights are bright or dim. A good plan is to place a small flash-

up small parts dropped into inaccessible places around the motor as illustrated above light bulb of the five-cell type under the dashboard and connect is from the dimmer side of the circuit to the ground. When the switch is on the dimmer side, the lighted flashlight bulb will tell the driver at a glance that his headlights are dimmed

Two old magnets from a Ford fitted with ex-

tensions, as shown at left, can be used to pick

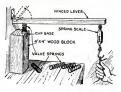


6-VOLT RADIO DIAL LIGHT OR TOY TRAIN BULB

Tiny bulb placed under the dashboard can be connected to show if lights are dim or bright

Testing Valve Springs

RELATIVE strength of valve springs can be determined by means of a simple compressing lever and a small spring balance. The lever is hinged to a wall above a stationary block. A small spring balance is attached to the outer end of the lever. To test a spring, place it on the stationary block, pull the lower end of the balance until the valve spring is compressed to almost its fullest amount, and then note the scale reading. Any valve spring whose scale reading varies greatly from the average of the set should he discarded and replaced with a new one.



Relative strength of valve springs can be ascertained with lever and balance as shown

What Use Can You Make of an Old Auto Engine

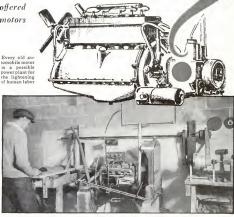
A first prize of twenty-five dollars and seven other cash awards offered for ways to utilize discarded motors

TACK of electricity in his home in Charles City, Iowa, did not deprive Oscar Immer, an ingenious reader, from enjoying the conveniences of a modern motor-driven home workshop. An old automobile engine mounted as shown in the accompanying illustrations solved his problem for a total cost of \$10.

Can you think of other ingenious and practical ways to install and use a discarded auto engine in the home or shop, on a farm, or in a boat? Perhaps you have a definite idea and may even have gone as far as to draw up plans. To bring out practical suggestions along this line and make them available to other readers who may have similar problems, Populas Science Moornur offers eight prizes for mobile or motorcycle engines. The prizes to be awarded are as follows:

If you have a practical suggestion on this subject, sit down and sketch it out. Then write not more than 500 words describing the installation and tell how you would mount the motor in the most work-manlike and economical way. The drawing showing the arrangement need be nothing more than a simple pencil sketch so long as it shows clearly the application of the auto or motorcycle engine.

It is not even required that you actually are using a motor in the manner you describe. Of course, if you have already put your idea into practice, you may enter the contest, adding any improvements that have occurred to you. In this case it is suggested that you supplement your entry with a photograph or two.



The workshop of Oscar Immer, of Charles City, Iowa. Lacking electric power, he se up an old auto engine to drive his lathe, saw, and other machines, which he made himsel-

Entries in this contest should be mailed before November 1, 1932, to the Auto Engine Contest Editor, POPULAR SCIENCE MONTHLY, SIS FOURTH AVENUE, NEW YOR, N. Y. The judges of the contest will be the automobile and home workshop editors of POPULAR SCIENCE MONTHLY. Their decisions, which will be final, will be based on the ingeniousness and practicability of the ideas entered. In the case of ties, each tied in the ideas entered. In the case of ties, each tied for Only one idea may be submitted by each contestant. This contest is open to all except employees of POPULAR SCIENCE MONTHLY and their families.

You will see at once that the possibilities in this contest are almost unlimited in number, the use to which Mr. Immer put his old engine being only one of many. A study of this particular installation and use may, however, aid the reader in planning his own

The automobile engine, which is from a model-T Ford; is mounted on two rein-forced concrete supports so that the main shaft is at a convenient height for coupling in the main drive of the pulley system. To lessen vibration, wood blocks were placed between the motor and the concrete supports.

The original housing, cut off just back of the rear bearing on the motor, acts as the front bearing for the pufley drive shaft. The other bearing is of the pillow block type supported by a wooden bracket which is fastened to the concrete wall with law screws.

To lessen vibration in the system still more, the wooden pulleys on the machines were assembled in such a ratio as to allow the engine to operate at its slowest practical speed and still deliver the required

speed at the machines.

A small pipe brings the gasoline by gravity feed from a tank hung on the outside wall. The exhaust is carried outside through a length of ordinary automobile exhaust pipe. Because of leaky pistons it was also found advisable to replace the breather cap on the crank case with a small pipe arranged to lead the crank case gases outdoors.

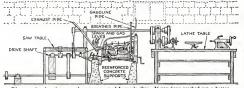


Diagram showing the general arrangement of Immer's shop. If you have worked out a better solution for this problem or can suggest another use for a motor, enter it in the contest

IACK HAZZARD tells how to complete the framework of

The kayak is 16 ft. long, has a beam of 27½ in., and is 11 in. deep amidships. It weighs about 35 lb. ready to launch, but will hold two men with light camping gear or one with full cruising equipment

Our Speedy New Canvas Covered KAYAK

ITH the growing popularity of the Eskimo type of canoe, more and more requests have been received from readers for plans of an easily built, light, fast, and generally serviceable canvas covered kayak. How to set up the keel, stems, frames, and longerons of such a canoe-one designed especially for Popular Science Monthly readers-was told last month (P.S.M.,

readers—was told last month (F.S.M., Sept. '32, p. 57).

The next step is to fasten the wales.

These are let into the frames from ½ to 34 in, While cuts have been made for this when sawing out the frames, adjustments must be made as most of the joinings are on the slant. Tie the wales in position and make an improvised wooden gage block to aid in marking the frames. Saw the notches with a hack saw.

Tie or clamp the wales in position and check for imperfections in the sheer. A level laid across the frame is a good check at each station, but it is hard to beat the eye, provided a sufficiently dis-tant point can be had from which to survey the job. The wales are secured The longerons are tied in place at each station, then glued and lightly nailed. Afterwards the nails are pulled out and screws driven

Below: The wale is tied on temporarily and the cuts into which it is to fit are then marked with a wooden gage

with 2-in, screws driven into the ends of the carlines and glued.

Because the wales are larger than the longerons, more care must be exercised to keep them from splintering when bent, and it might be better to steam them. If this is decided upon, a large inner tube or a length of downspout pipe makes an excellent substitute for a more formal steam box. A half kettle of water boiling hard will furnish enough steam for the job in about forty minutes. Stuff the end of the pipe opposite the kettle with old rags loosely to allow the escape of water caused by condensation.

The outwales are cut from 7/8 by 34 in. spruce, the greater dimension being used in the vertical and the grain running through perpendicularly. The middle 4 ft. is left full size while the ends, each 6 ft. long, are tapered from the bottom to within 1/2 in. of the top and from the outer face to within 1/2 in, of the back.

Mark and cut the bottom taper on one end of one wale; then, using this end as a template, mark and taper an end of the matching wale. Use this second tapered end as a template by which to mark the untapered end of the first piece. Mark and taper the faces in the same manner, and work away the angles where the tapers run into the square portion of the wale.

Run a line ½ in, below the upper corner



The framework from above. Note the mast step and the cockpit coaming. The forward ends of the coaming must be steamed before they are bent, and fitting them requires careful work



Hazzard says: weigh 155 lb., the other chap 165, and my son 70, a total of 390, and still there's freeboard." Below: A sheer plan enough to take the tube, and use a plastic wood composition to plug the hole caused by the pilot of the bit. Bore a 1/4-in, hole each side of the keel to let out any water which may get into the step and another in the side of the tube 1/4-in, from the bottom.

At the level of the wale the tube passes through two pieces of 1/2 by 4 in. ash, one running fore-and-aft and one running athwartship. These are screwed and glued



are used, spaced 6 in.

It will be necessary to saw away the temporary carlines at stations 6, 7, 8, 9, and 10 to clear the way for the cockpit coamings, the forward ends of which must be steamed. At station 11 the side coaming strips run straight back to the reënforced carline. A short piece of coaming is cut to fit snugly between them, and a piece of quarter-round oak is glued and nailed in the corner.

Rest the forward ends of the coaming on the wales and, clamping them in place at frames Nos. 9 and 10, work forward to 9, then 8 and 7, forcing them slightly downward to secure a gradual rise from 34 in. aft to about 11/2 in. at the forward peak. From frame No. 8 forward there is an inward bend and an outward twist impossible of attainment without steaming.

Measure from inside the coaming perpendicularly above the afterface of the carline, horizontally to the center line. This measurement represents half the width of the stem block. Measuring from directly above the center of the carline to the inside of the coaming at the stem gives the fore-and-after dimension of the block: and from the point where these two lines meet down to the upper face of the carline represents the height at the afterside.

Square the end grain of a hardwood block and lay it off for making the stem block, Fasten this block to the end of the starboard coaming, fetch the port strip over to the center line, and mark the bevel as accurately as possible.

To hold the stem block down, make a metal fastening to fit the triangular inner face of the block and rest against the inner surface of carline No. 5.

Once the coamings are fitted, loosen a few screws at a time, insert glue, and tighten the screws permanently.

The mast step is a 1½-in, brass tube mounted securely on a piece of ½ by 2 in, maple, which is screwed and glued to the keel between frames No. 3 and 4 at a point 3 ft. 6 in, from the stem. Bore a hole half through the maple block just large

GAGE BLOCK MALL BLOCKS GLUED ON CARLINE

A PARALLEL MARK SHOWS THE BEVEL TO BE CUT

A simply made wooden gage block is used to aid in marking the notches for the inwales

together and screwed to the wales. To distribute the strain and to provide a beam upon which to tack the decking, pieces of 5% by 5% in. spruce are fitted, glued, and nailed between the frames along the center line from the apex of the cockpit to the stem head.

To provide a suitable ledge upon which to tack the deck, it is necessary to fit pieces of spruce between the frames and tightly against the outside of the coaming at the level of the wales. Apply glue and nail these pieces to the carlines, and run screws from inside the cockpit.

Frames that show inside the cockpit are sanded smooth, and the cockpit coamings are cleaned and sanded. The 3/16-in. plywood floor boards, which are fitted tightly just over the keel, are screwed in place. At the ends the boards will be about 6 in, in width, but they widen at the middle to almost 10 in. Give the whole frame two coats of spar varnish, preferably of the slow drying type. Rub down between coats only those parts which will be in sightcoamings, inside and out; upper side of floor boards; upper portions of frames Nos. 5, 6, 7, 8, 9, 10, and 11; and floor boards to wale. Make doubly sure to varnish the edges of all plywood frames, turning the canoe over after each coat to touch up places inevitably missed. A quart of varnish will be sufficient.

Next month instructions will be given for covering and finishing the kavak.



The completed framework ready for the canvas covering. The deck stringers, cockpit coaming, and floor boards can be seen, as well as the two mast steps. The after step, however, was added for experimental purposes and is not needed for ordinary use

The latest idea for keeping your home shipshape . . .

Log Cabin Recreation Room

BY USING log siding—boards rounded on one side to look like pine logs stripped of bark—any home owner can transform a part of his basement or attic into what appears to be the cozy interior of a log cabin. Ship-lapped joints along the edges of each strip of siding make it extremely easy to apply.

An unfinished attic is well adapted for log siding, since the wall studs supply the right sort of backing. If the siding is to be applied to a concrete basement wall, it will be necessary, of course, to erect fur-

ring strips. Being available in several widths, the log siding gives a most realistic effect. At the corners of the room the siding can be mitered, or alternate strips may be allowed to jut through to give the interlocked effect of the logs in a real cabin. Stripes of grayish-white wall paint applied to the joints between the "logs" will imitate the chinking. Log siding can also be used in

building up the doors.

In planning a basement or attic recreation room, try to make use of existing conditions as far as possible to carry out the cabin design. Attractive casement sash can be substituted for the usual attic windows; and if the recreation room is to be in the basement, leaded glass sash of simple design can be substituted for the ordinary unattractive cellar sash. Should an extra window or two be needed for the sake of appearance and it is not desired to cut in real ones, imitation windows can be placed where necessary. Bookshelves and a fireplace—the latter either imitation (see P. S. M., Dec. '31, p. 98) or real—will add to the effect. If the use of a genuine fireplace is possible, a wood box can be built into the adjoining wall space in imitation of a quaint Dutch oven.

When purchased, log siding is the nat-



ural pine color, but several coats of silver gray oil stain will give it a pleasing aged appearance. If desired, a rustic finish can be obtained by using dark brown stain.

Your log cabin recreation room can be made a complete unit in itself by planning ample closet space for the storage of games and bridge tables and fitting up a small buffet closet with an electric grill for preparing midnight suppers.-G. W.

OCTORERShipshape Home SUGGESTIONS

Clean out chimney and smoke pipe Flush steam boiler and water tank Insulate steam pipes

Clean water gage on furnace

Check radiator valves

Clean basement

Repair broken or cracked windows

Special Flashing Strips Stop Leaks in Roof

 $B_{\ \ in\ \ the\ fashion\ \ shown\ \ below,\ it\ is\ a}^{Y\ CUTTING\ and\ folding\ sheet\ \ copper}$ simple matter to insert new flashing in leaky closed valleys on a shingled roof. The point of the folded flashing piece can easily be slipped under the shingles and pushed into place, the triangular shape making it possible to avoid striking the shingle nails. The size of the sheets to be used depends on the pitch of the roof and the exposed area of the shingles. Start placing the flashing at the bottom row of

shingles and work up toward the top of the valley. If the shingles are tight and the roof is otherwise in good condition, no nails will be required to hold the flashing in place.-G. C. B.



How the flash-ing strips are cut, folded to suit the angle of the valley, and pushed up under the rows of shingles so that one over-laps the other

Drilling Open a Drain

A PORTABLE elec-tric drill and a 3or 4-ft, length of stiff wire cable can be used for cleaning clogged floor or laundry drains. Ravel about 2 in, of the cable at one end and clamp the other end firmly in the drill chuck. The frayed end will drill through obstructions that will not otherwise yield .-- C. P.



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SKF

A PROMISE IS ONLY A PROMISE...PERFORMANCE IS HISTORY

Getting a Good Start in Home Movies

By Frederick D. Ryder, Jr.

HERE are more ins and outs to this home movie game than I anticipated," an amateur photographer told me the other day. "The wife," he went on, "has been pestering me to take movies of the children, and I've agreed to get an outfit. I thought all I had to do was to go buy it. Now I discover there are two kinds of film and so many different kinds of cameras and projectors I'm in a daze. I always thought taking movies was just taking little pictures in wholesale lots, and there shouldn't be anything complicated about that. What kind of an outfit should I buy, and why?"

I buy, and wny? If you, like this man, are thinking of breaking into the amateur movie game, you ought to get clear in your head the essential differences between the still photography you have been doing and the motion picture photography you have been doing and the motion picture photography you have been doing and the motion picture photography will be in a lot of ways, and what you know about still photography will help you with the other game. But there are important differences in the technique and in what you can and cannot do.

Motion picture photography is, after all, just what its name implies, the photography of motion. A picture of a house or a distant view is no better in the movies than it is in a still picture. On the other hand, a still picture of a child playing may be interesting in a way, but nevertheless it can only be a frozen impression of some fleeting glimpse of the youngster. The movie camera actually cute tricks the kid does with its fance, its hands, and its feet. The movie film, in other words, records life, while the still camera only freezes a momentary view of any subject into perpetual immobility.

A lack of understanding of this sessen-

A lack of understanding of this essential difference probably explains why many movie beginners get uninteresting results out of their first few reels of film. Planting little Willie in front of the camera and letting yards of film grind through the mechanism while Willie gapes into the lens will not produce a film that will hold your friends; attention.

your friends' attention.

Keep in mind that the motion picture camera is designed to record life and movement and encourage the children or any



Indoor movies at night-even in full color-are easily taken. Photo-flood bulbs in your own floor lamps supply ample illumination. Fewer bulbs are needed if special reflectors are used

other human subject to engage in some normal occupation that includes action while you do the shooting.

Another movie mistake that the experienced still photographer is just as likely to make as is the rank beginner consists in making the shots too short. When you press the button to start the mechanism, keep it running for at least ten seconds. A flickering glimpse that terminates before the audience gets a really good look is most annoying.

A third beginner's trick is to wobble the camera or swing it too rapidly. The first causes the picture to jump all over the screen, and the second makes one dizzy to watch.

These are, of course, just samples of the differences in movie technic as compared with still camera photography. As far as the mechanical possibilities are First, there is no such thing as doing your own finishing in amateur motion picture photography. You just press the button and leave it to the manufacturer to process the film. This is of interest only to the relatively few more advanced amateur photographers whose chief interest in the subject lies in the work of developing, printing, and enlarging—in other words the chemistry of photography. Amateur photography and the process of the p

concerned, two vital differences stand out.

in the subject lies in the work of developing, printing, and enlarging—in other words the chemistry of photography, Amateur movie making will have little appeal for such a man.

Of far more general interest is the fact that amateur motion picture photography

that amateur motion jetture, photography offers the only practical and simple way to take pictures of things in full and completely natural color. Recent developments have made this feature of the amateur movie game of still greater importance. Now, with the aid of the new super sensitive color film, you can take full color pictures on slightly cloudy days smight, as was having to wait for blazing sunlight, as was film is so extremely sensitive that full color movies can be taken indoors at night with the aid of several photo-flood bulbs costing only thirty-five cents each!

The first question for you to decide as a prospective amateur movie photographer is the matter of size. There is the regular sixteen-millimeter film and the new split-sixteen (P. S. M., Sept. '32, p. 27).

You will decide on the split-sixteen film if cost of operation is of paramount importance, because this size film gives four minutes of projection time at a cost of two dollars and a quarter compared with six dollars for the same amount of screen projection with the regular six-teen-millimeter film, or nine dollars if you wish your pictures to be in full color.

Within its projection size limits, the split-sixteen gives virtually as good results as the regular sixteen, assuming cameras and projectors of equivalent grade. But the regular sixteen-millimeter

Photo Contest AWARDS



. It's so EASY to make clear, brilliant home movies with this simplest of home movie cameras. Aim . . . press a lever ... and that's all. It's as easy as making snapshots.

The Wonderful Story of Growing Up



Your Movies of it will be your Family's most precious Possession

H^{OW} priceless the living movie record of your baby's smile . . . the first uncertain steps . . . playing in the sand . . . the drama of going to school . . . sports . . . picnics . . . the first party dress or first long trousers . . . milestones on the road of growing up.

Such movies are so easy to make with Ciné-Kodak, And they are vivid with the reality of lifelike action. A record of your child that time cannot dim-a priceless possession in years to come. And not expensive either.

Ciné-Kodak is as easy to use as a

Brownie. Aim . . . press a lever . . . that's all there is to it. Make perfect movies the first time you try. We do the rest, finish the film and return it ready for your Kodascope projector.

Your dealer will gladly show you typical Ciné-Kodak movies. Stop in and see him. Eastman Kodak Company, Rochester, New York.

Ciné-Kodak Simplest of Home Movie Cameras



CINÉ-KODAK MODEL K This versatile, allpurpose camera permits quick change of

lenses and can be fitted for Kodacolor (movies in full color). Loads with full 100 feet of 16 mm, film.

You Pay No Tax . . . The government has placed a ten per cent tax on cameras and on other articles that you use in your leisure hours. But as all outdoors invites your Ciné-Kodak, this company will not let anything interfere with that invitation. It will absorb the tax. No increase in the price you pay for any Eastman camera.

film makes possible much larger and brighter pictures and also pictures in full color, an impossibility with the splitsiyteen

If you have done much still photography, you are quite likely to make the common mistake of considering the camera more important than the projector. As a matter of fact, the quality of the projector is more important because you use it more often. The projector is more in spendiare that the projector is more in spendiare that is not the projector and the projector and end up with poor pictures on the screen.

Remember that you are almost sure to become interested in commercially produced sixteen-millimeter film subjects, and the success of home entertainment with these films depends on the quality of the projector.

Now about the prices of equipment. You can get either



Fitting a three-color screen is the only change required for color movies

a movie camera or a movie projector for the regular sixteen-millimeter film at almost any price from about thirtyfive dollars up to several hundred dollars. If you wish to go in for full color photography later on, then you must have a camera with an F/1.9 anastigmat lens made to fit the special color filter used in exposing the color film. Such a camera will cost you about one hundred and fifty dollars or more. The same applies to projectors. If you want to project full color movies, you must have an outfit made to take the special color projection screen that fits over the projection lens. Such a projector calls for an outlay of one hundred and fifty dollars or more

At present there is only one movie camera and two sizes of projectors made for the split-sixteen film. The camera and the smaller projector total a bit over fifty dollars.

Real Plants Thrive in This Tiny Toy Greenhouse

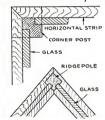


Although intended as a toy, this miniature greenhouse, which is built from scrap material, will prove interesting to grown-ups as well as children. It can hold a dozen or more tiny pots with growing plants, or two or three larger ones.

The greenhouse illustrated was made from store-box lumber and a number old 4 by 5 in photographic plates cleaned with hot water and an old razor blade. Of course, you can use scraps of window glass cut to size just as well.

The most suitable wood to use is cypress because it resists moisture, but almost any wood will do. The base is 1 by 73½ by 13 in. A molded edge was cut to improve its appearance. Overall dimensions of the house, exclusive of base, are: width, 5¾ in.; length, 11 in.; height, measured to apex of roof, 7¾ in.

After shaping the base, cut corner





The framework is constructed as shown in the detail drawings above and in the photo at the right. The top lifts off bodily to give access to the plants as in the photo above, and the closed greenhouse is shown at left above pieces and other uprights as needed, and fasten them to the base with nails and glue. Space them so that the glass pieces will side into ½ in. deep grooves. Run 3/16 by 3/16 in. strips around the base between the uprights to seal the lower edges of the glass. Connect the top ends of the uprights with similar strips, placed at one side so that the glass can be slipped at one side so that the glass can be slipped

into the grooves or removed. The roof is separate, serving the purpose of a removable cover. In constructing it, first make a rectangular frame of ½ by ½ in. material so that it will coincide with the top edge of the house proper Then construct triangular ends, the diwidth of the glass side panels used. The ridge piece is square in cross section and grooved on two adjacent surfaces. Spacers for separating the glass panels are grooved on the edges and measure about 3/16 in.

or ½ in, thick by ½ in, wide.

Fasten the wood frame together with
casein glue and small nails or common
pins used as malls. It is best to paint or
lacquer all wood parts possible before assembling. The tiny earthenware pots can
be obtained at almost any florist's. If
desired, a metal tray can be placed on
the bottom—JOHN C. WORKLEY.



POPULAR SCIENCE MONTHLY

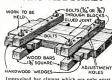
AUXILIARY BENCH AIDS THE MODEL MAKER

MY BENCH being pretty well taken up with lathe, emery wheel, saw, and other tools, I had to resort to what I call



made of any stock about the shop; mine is a piece of ½-in. pine, 8 in. wide and 24 in. long. Across one end a piece of ½-in. hardwood, 2 in. wide, is screwed to serve as stop for planing. On the other end a V-notch 3 in, wide and 4 in. long is cut to allow a coping saw or fret saw to be used. A block about 1½ by 2½ by 12 in. is screwed underneath and in the middle of the large piece to allow the auxiliary bench to be clamped in the vise at a comfortable height.—G. T. Hon.Mss.

HOMEMADE CLAMPS FOR GLUING WIDE BOARDS



Improvised bar clamps which not only exert pressure edgewise but also hold work flat

WHEN two or more boards have to piece, it often happens that there are no cabinetmaker's bar clamps at hand, or too few clamps for the number of joints which have to be made at one time. The accompanying drawing shows a homemade clamp that is inexpensive and efficient. The dimensions given are satisfactory for bars up to 2 ft. in length; for longer clamps, both the bars and the bolts should be dreamed to the board of the clamps. The dimension was the large enough blocks should always be slightly thinger than the material to be clamped. In use, the clamps should be slipped over the work, and the nuts drawn moderately tight; then the wedges should be driven in firmly.—HARRY N. ROWLAND.

$^{*}200$. a month for life



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NICHOLSON FILE COMPANY Providence, R.I., U. S. A.



0

INEXPENSIVE

Dividing Fixture



ANY otherwise difficult or impossible operations in the home machine shop become comparatively easy when a small dividing fixture like that illustrated is available for use on the lathe, milling machine, or shaper. It can be used for spacing the flutes on reamers and taps, for cutting teeth in milling cutters, for cutting square and hexagonal ends, and also for making gears with a fly cutter.

with a ny cutter.

The device was constructed by B. L. Kemper, a druggist of Perham. Minn., who has for many years made a hobby of his home machine shop. He makes many of his own tools and has built much of his equipment, including both a milling machine and a shaper.

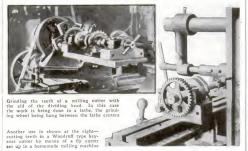
For obtaining the divisions for this including head, Mr. Kemper makes use of the screw cutting gears of his lathe. They give him every division from 2 to 16. then every even number up to 32, and also 36, 40, 44, 48, and 52, which is a sufficient variety for almost any amateur work.

"The accompanying photographs," Mr. Kemper writes, "will explain the device well enough as the dimensions naturally depend upon the machines available. The

base consists of three castings—the base plate and the two supports for the centers. The base plate could just as well be made from a piece of cold-rolled steel about ½ in, thick and 4 in, wide, which would eliminate the facing operations necessary in cast iron. The two center supports are made from the one pattern, and the tail center and its support are threaded for the casy removal of the work. Both supports are supports are supports are threaded for the casy removal of the work. Both supports obtained to the control of the work. Both supports of the work will be tailed the work of th

COLORING BRASS BLACK

A BLACK finish for brass can be obtained by a simple chemical process. Make a strong solution of nitrate of silver in one container and of nitrate of copper in another. Mix the two solutions together and dip the brass into it. Now heat the brass evenly until the required degree of dead blackness is obtained. This is the method often used by instrument makers—L. H.



A FILE FOR EVERY PURPOSE

SHEET OF PAPER REMOVES DUST FROM AQUARIUM



When the sheet of newspaper is rolled back from the water, it carries the dust with it

EVEN though an aquarium is covered with glass, a certain amount of dust will invariably accumulate on the surface of the water. The dust impairs the natural beauty of the aquarium and is detrimental to the fishes. To remove it quickly and easily, cut several sheets of newspaper approximately the size of the water surface and spread one of the sheets on the water. Let the paper remain until it begins a soak up the water begins are soak up the water begins of the sheet o

OLD INNER TUBE STOPS RUGS FROM SLIDING



TRIPPING over a small rug which has rug slips on a polished hardward floor is a common household accident. It is easy to prevent such accidents, however, by applying commercial preparations to the back of the rug to prevent their slipping or curling up at the comers. Upturned common their suppring or curling up at the comers. Upturned common their suppring or curling up at the comers, upturned common their suppring the common their suppring is to see the common their suppring the common their suppring is to see a strip about 5 in, wide along the edges on the back of the rug. Have the inside of the inner tube facing outward so that it will be in contact with the floor. A rug so treated will not slide even when a vacuum cleaner is used—Jonn to Win Ne Wink.

THE MAN WHO COULDN'T KEEP A JOB __ by Trim, inf



LITTLE THINGS ? WHAT WAS ELSE ENHITHER AT ? HAVENT THE LEAST IDEA

A MONTH LATER he found out

AND THE METERS AND THE METERS TO WORK

YOU SAY HET BRIGHT

AND HARDWORKING,

BUT CARLESS ABOUT

B.O. SUBERT HARTS

A UTTLE THING

WHAT A FOOL I'VE BEEN! I'VE SEEN DOZENS OF "B.O. AGE, BUT NEVER DREAMED FOOLD BE GUILTY. "BLLL, INOW MON-AGE AGE. "AGE OF THE SEEN DREAMED FOOLD BE GUILTY." BLLL, INOW MON-AGE. "AGE OF THE SEEN BE GUILTY." BLLL IN MON MON-AGE. "AGE OF THE SEEN BE GUILTY." TO AGE OF THE SEEN BE GUILTY." TO AGE OF THE SEEN BE GUILTY. "AGE OF THE SEEN BE GUILTY." TO AGE OF THE SEEN BE GUILTY." TO AGE OF THE SEEN BE GUILTY. "AGE OF THE SEEN BE GUILTY." TO AGE OF THE SEE

5 NO "B.O." NOW to spoil his chances

I'VE BEEN IN MY JOB SIX MONTHS, ELSIE. HAD A NICE PROMOTION, TOO. ISN'T IT TIME TO TALK ABOUT A WEDDING?



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To ASSIST you in your home workshop, Popular Science Monthly offers large blueprints containing working drawings of a number of well-tested projects. The blueprints are 15 by 22 in. and are sold for 25 cents a single sheet (except in a few special cases). Order by number. The numbers are given in italic type and follow the titles. When two or more numbers follow one title, it means

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(See page 90 for kit of materials)	
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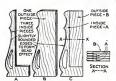
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A SIMPLE WAY TO MAKE REEDED CHEST LEGS



A substantial chest leg built up from four pieces 1/2 in. thick to give a molded effect

AMATEUR woodworkers usually avoid any attempt at molding long, ornamental beads, reeds, or flutes on furniture parts unless they have a special plane or a routing machine suitable for the work. In many cases, however, a beaded effect can be obtained by building up the parts from several thin pieces. The chest leg illustrated, for example, was made of four pieces of 1/2 in, thick material sawed to shape, three being inside pieces as shown at A in the drawing, and one an outside piece like B. The pieces were lightly nailed together and the edges trued up and made exactly alike with a wood rasp and sandpaper. Then they were separated and the



The leg is made by cutting three pieces like A and one like B, and assembling them as at C

front edges rounded to give a beaded

effect, as shown at C.

When finally glued and bradded together, these legs had the additional advantage of providing a strong support for the bottom of the chest and an unusually rigid corner construction. With a little ingenuity, this method may be adapted to many purposes .- CLINTON F. BLAKE,

EVERY owner of a small power shop is likely to have trouble with slipping belts. I have tried various commercial belt dressings, but have found nothing better than a stiff paste of powdered rosin in castor oil. It keeps the belts soft and pliable and makes them pull well.—B. L.

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DECOY DUCK HEADS PACK INTO BODIES

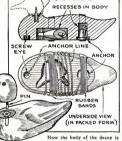


With heads and anchors packed inside their bodies, the decoys can be more easily carried

When hunting ducks, one has a heavy, bulky load to pack to the blinds, especially if many decoys are used. A few heads became loose on the writer's decoys. and this suggested the idea of making each head detachable so that it could be packed with the anchor in the body of the decoy.

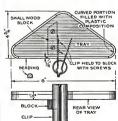
A brass pin was threaded into the head in place of the dowel, and a caster socket fastened in the body. A hole slightly larger than the profile of the head and 11/2 in. deep was centrally located in the underside of the decoy. Behind this a second hole was bored with an expansive bit to hold the anchor. At the forward end of the decoy, centrally located on the underside, a third hole was bored to con tain the brass screw eye for fastening the line to the anchor Small buttons of lead were added as necessary to balance the decoys, A 3/4 in, wide rubber band cut from an old inner tube keeps the anchor in place. and the anchor line is wrapped around the body to prevent the head from falling out. To make still more sure that the head will not slip out, another rubber band like that used for the anchor may be applied .-C ANTHONY VAN KAMMEN

CASTER SOCKET



TRAY CLAMPS ON LEG OF CARD TABLE

A NEAT little tray that holds two glasses and an ash receiver safely below the surface of a card table can be made from a piece of 3/8-in. pine cut in a triangular shape with rounded corners, as shown. A strip of wood beading should be glued along each of the straight edges, and the



The tray consists of a triangular piece of 3/2-in. wood with a big spring clip attached



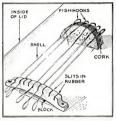
Small as it is, the removable tray has room for two glasses and an ordinary ash receiver

rounded corners filled in with a plastic wood composition, which is later shaped with a file to match the beading. A large size spring clamp, obtainable at a sta-tionary store, is attached to a block underneath. It will hold the tray firmly on either round or square table legs.

A piece of felt or blotting paper is placed in the bottom of the tray to absorb liquids. A pair of these trays will help keep the top clear for playing .- E. E.

STORING SNELL HOOKS IN A TACKLE BOX

SNELL hooks can be stored in perfect order inside the lid of your fishing tackle box by means of the simple arrangement illustrated, Half of a large, flat cork about 2 in, in diameter is first nailed in an upright position to the inside of lid. This is for the points of the hooks. The snells are kept in place with a fastening



The fishhook points are set into the cork, and the snells are slipped into the siits

which resembles a violin bridge to some extent, but is cut from soft rubber (a piece of an old eraser will do). This is 2 in, long and about 3/8 in, square and has deep slits cut across its upper edge. It is attached to the lid with nails and is blocked up in center so slits remain open.

To place a hook, push the point into the cork and pull the snell taut, inserting it in a slit directly opposite the hook. Snells cannot get tangled if properly arranged, and they will dry straight.—P. B. PRICE.

ADJUSTABLE INSERT FOR SMALL SAW TABLE



Six oval-headed screws placed as shown make possible to adjust the insert accurately

THE wood insert in the center of the iron table of a small circular saw will shrink in winter and swell in summer, especially if the machine is in a basement shop that is relatively damp at times. Sometimes it may have to be hammered out; at other times it will be loose and not quite flush with the top of the table. Such an insert, however, can be kept snug. Take it out when it is tight and rip 1/8 in. from one side: then drive two 1/2-in. No. 4 oval-headed screws in the cut edge about 1 in, from the ends. These screws can be adjusted in and out as necessary, Similarly, about 1/16 in. can be planed off the bottom and four screws used for the vertical adjustment .- C. W. Olson.

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TUNNEL GOLF-A NEW BLIND-TRAP GAME





The maze as made by the author. The black dots indicate dowels which block the tunnels

TUNNEL golf is a new, novel pastime for fall and winter entertainment. To make it, three 10-in, disks of three-ply veneer are used, with a steel ball bearing to serve as the "golf" ball. Place one of the disks on the scroll

Place one of the disks on the scroll saw and cut it up into a spiral strip about ½ in, wide, as illustrated. Cut this up into various lengths and glue part of it to another disk to make a "magic maze" with channels or tunnels through which the ball bearing can roll easily. The passaction of the ball bearing can roll easily. The passace with "trap" as shown, these stops are merely short pieces of doweling glued firmly. Part of the remaining spiral strips are then affixed to the remaining glisk in such a way that they will mesh or interlock properly when the disks are placed together.

A hole is made for entrance of the ball bearing near the center of one disk, and a gap or opening in the outermost spiral strip provides an exit at the edge. The prepared disks are then fastened together with a central bolt.

The player holds the round game board thus made and drops the bearing into the hole near the center. From there on the hole near the center. From there on the "gofing" is "blind" and must be completed by a sense of balance and feeling. If the ball can be maneuvered so as to miss the traps, it will make an exit at the side. When a player becomes accustomed



Cutting the spiral strip on a scroll saw

to the arrangement, revolve the top disk sufficiently to change the relation of the "traps." Prizes can be given for winning in the shortest time.—KENNETH MURRAY.

WOODEN CASTER WELL HOLDS STEEL WOOL

A wooden caster well of the type illustrated at the left makes an unusually good holder for steel wool, especially when polishing metal or when a coarse grade of steel wool is being used. Larger areas of the wool are presented to the work than when the steel fibers are held in the fingers, and steel splinters cannot enter the skin—R. W.

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SMALL PICKET FENCE HIDES FLOWERPOT

A MINIATURE picket fence to cover and partly conceal an unsightly clay flowerpot can be made as shown from about twenty-four pieces of ½-in. halfround wood molding or beading, each approximately 6 in. long.

Whittle one end of each piece to a point and sandpaper it thoroughly. Cut a ½ in.



Neatly painted pickets held at the top by a rubber band form this novel flowerpot holder

wide rubber band from an old inner tube and fasten the strips to it with ½-in. tacks, clinched against a piece of metal. No spaces should be left between the strips, as they will spread apart when the band is stretched over the flowerpot. The circular cover of an old can may be used as the base.

It is best to paint the pickets, rubber, rail, and base some bright color before putting the parts together. Then slip the assembled fence over the flowerpot from the bottom and tuck the lower ends of the pickets inside the rim of the can cover which forms the base—E. T.

REPLACING EYELETS IN A PORCELAIN DOLL

BENT COTTER PIN

BURNING-IN

WHEN an eyelet breaks out of one of the porcelain arms or legs of a doll, fill the hollow part of the arm or leg with soft cotton waste to within ½ or ¾ in, of the top and then insert a cotter pin through the hole, as illustrated. Melt a small amount of stick shellac of the kind used in roorceal-

of stick shellac of the kind used in concealing blemishes in furniture and pour it

around the cotter pin until the opening is full, or use sealing wax, rosin, or the composition with which dry cells are sealed. The cotter pin should be set perpendicular to the joint surface of the arm or leg.—GLENN W. HARDING.



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EXPERIMENTS WITH GAS FOR HOME LABORATORY

(Continued from page 55)

solubility. It is by this means that salt is extracted from sea water. Large ponds of sea water are allowed to evaporate and as the solution becomes more and more concentrated the salt crystallizes out while the more soluble substances remain behind.

Some chemicals exhibit curious color changes when made into solution. Copper bromide crystals shaken with a very small amount of water produce a reddish brown liquid. Adding a very small amount of water makes a green solution. If still further diluted, the liquid will become blue.

Cobalt chloride or cobalt nitrate dissolved in water and applied to a white cloth will color the cloth blue or red, depending on the amount of moisture present in the surrounding atmosphere. The little "weather forecasters in the form of flowers or dresses on cardboard figures are made of cobalt-chloride treated cloth. When there is little moisture in the air, the crystals of cobalt on the cloth remain blue. When the humidity increases, the cloth becomes red or pink. You will have no trouble in making these moisture indicators in your home laboratory from cloth and cobalt chloride

SANDING SHARP CURVES ON POWER JIG SAW

THOSE who have used disk and drum sanders and have learned how much labor they save will appreciate a method for sanding small, sharp curves and inside cuts that cannot be reached by these tools. The idea is simply to utilize the power scroll saw or jig saw for this work by making sanding blades of various sizes and degrees of fineness. This is done by gluing sandpaper to a metal backing. The metal may be any old scrap, or a piece may be cut from a tin can. The metal blank is made the same length as a fret saw blade; and if from an old can, the outside of the tin should be coated with shellac to make the glue take.

Both sides of this blank are coated with glue. A piece of sandpaper or cloth of the desired grade is then placed against the glue, and the whole set between two hardwood blocks and clamped in the vise overnight. Then strips are cut from the blank with the tin snips, varying in width from 1/8 to 3/8 in. These strips, which must have both ends cut to enter the slot provided for the fret saw

blade, are used as required. As the blades are so easily and cheaply made, a good supply of various grades may be kept on hand. Ordinary sandpaper may be used, but the cloth wears longer. Emery cloth, however, is not suitable for use on wood.-H. CALDWELL.

COMPRESSION GAGE COCK IMPROVES BLOWTORCH

IF THE needle valve on many ordinary types of blowtorches is left closed after use, the contraction of the metal around the hole against the needle valve may enlarge the hole and ultimately make the torch useless. Of course, the needle valve may be left open and the pressure let out of the tank by unscrewing the pump, but a better plan is to thread a com-pression gage cock into the top of the tank under the rear end of the burner. A cock of the needle variety must be used; any other kind will leak. As the thickness of the tank metal is too thin to support the cock properly, a ridge of solder should be built up around the base of the cock.

When through using the torch, extinguish the burner, reopen the valve, and then open the compression cock.—A. L. Evans.





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GUIDE FOR ANGULAR CUTS IN CYLINDRICAL STOCK



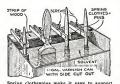
How to hold tubing, dowels, and other cylin drical stock which must be cut at an angle

IT IS difficult to saw off several pieces of brass or steel tubing, or even broomsticks, dowels, or other wooden cylinders, at a given angle and have all cuts xactly alike. A good way to accomplish this is to make a sort of miter box from a piece of hard wood an inch or more thicker than the outside diameter of the cylinder to be cut and wide enough to be held firmly in the vise. Bore a hole through the block large enough to allow the cylinder to be pushed through easily, but not too loosely. Make a cut or cuts in the block at the required angle or angles.

As there is always a tendency for the stock to turn while being sawed, it is well to scribe a line the entire length of the top of the cylinder as at A and make a corresponding mark on the block at B. If care is taken to see that line A on the cylinder and line B on the block coincide at all times, the cuts will be uniform and will match each other accurately .- A.K.C.

HANGING PAINTBRUSHES IN CAN OF SOLVENT

AMATEUR painters frequently find it a problem to keep their brushes soft. My plan is to cut out one side of a 1-gal. varnish can and put a strip of wood along one of the top edges as shown. To this strip I fasten several spring type wooden clothespins by passing a screw through



the brushes so that the bristles are covered

the spring of each. A quantity of whatever solvent is to be used is then poured into the can, and the brushes, whatever their length, are suspended from the clothespins so that the bristles will be covered by the solvent yet will not touch the bottom or sides of the can. An improvement would be a cover to go over the entire can as a protection against dust .- KENNETH BARNES,

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BRAIDING FLEXIBLE LEATHER HANDLES

U NUSUAL handles suitable for a variety of uses can be made from leather thongs. The illustrations show the construction of a braided switch pull for use on a floor lamp that was made from an ancient musket. The leather matches the lamp perfectly.

Obtain some calfskin or similar leather in sheet form, and cut strips about ½ in, wide. The length will depend on the size of the handle, but pieces can be spliced if necessary by beveling the ends and fastening with a good leather glue.

and respectively with good hat ther situation are found in the solution of the solution will cross two others—over one and under the other as shown clearly in the photo below and in the accompanying diagram. Now bring the short ends together

and clamp them in a vise, or tack them to the workbench, and proceed to braid the handle in the manner illustrated. In bringing over the first thong to start each round, leave a loop through which the end of the last thong can be passed. Draw all picces tight before proceeding with the next round.

Leather comes with only one surface finished. If the thongs are laid with the finished sides up at the start, the com-

pleted handle will have, on each of its four surfaces, a strip of finished leather paralleling a strip of unfinished. This arrangement can be varied by turning two of the strips over at the start. The design can be modified further by using different colored thongs in any way desired. The completed handle will not unravel

am. Now bring the

The braiding process is illustrated above, while the diagram shows the arrangement of thongs at the start

This decorative switch pull with its braided leather hamp made from a music

LEATHER STRIPS

unless the ends are trimmed close. In that case, apply a little adhesive. The method of attaching the handle to a cord or other object will depend largely on the object.

Leather is not the only material that

Leather is not the only material that can be braided in the manner described. Heavy cord, rope, flexible wire, and the like can be used.—Vernon B. Case.

FEATHERED CORNCOB DARTS USED IN TARGET GAME

ARTS made from long straight corncobs with four turkey or chicken wing feathers inserted in the but the straight of the straig

deal to insure accuracy and higher scores. Each player tries to place a dart as close as possible to a stake driven in the ground at a suitable distance away from the line on which the contestants stand. If preferred, a bull's-eye may be marked on the ground and scoring rings used, but there should be a stake in the center to aim at. This is the arrangement shown in the drawing above—GEORGE A. SMITH.



HOW TO WATERPROOF MATCH HEADS

MATCHES to be used while camping can be made entirely waterproof, and they will also hold a large flame when lighted in the wind, if the heads are first dipped in a celluloid solution and allowed to dry. The solution is made by dissolving celluloid scraps in acetone.—G. S. G.



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TENON CUTTING GUIDE FOR CIRCULAR SAW

ACCURATE tenons can be cut on a small circular saw with the help of the auxiliary fence shown in the accompanying illustration. This device is made of 1-in. stock fastened throughout with screws. It may be built to fit whatever saw it is to be used with, but in any event the elevated cross member should, be at least 10 or 12 in. above the saw table.

Before the auxiliary fence is put in place, the regular fence on the saw table is set properly to cut a tenon of the desired width. It is possible to do this so that first one side of the tenon may be cut and then, by reversing the stock, the other side, without change of fence ad-



This quickly made auxiliary fence helps in cutting tenons accurately on a circular saw

justment. The saw table is, of course, set to cut the right depth—in this case, the length of the tenon.

To function properly as a guide to the stock being cut, the inner edge of the upper cross member of the auxiliary fence must be in the same perpendicular plane as the inner face of the regular fence on the saw table. This may be insured by using a carpenter's steel square with one edge on the saw table and the other edge against the inside face of the regular fence, extending upward. The square should be used first at one end of the fence and then at the other, and the edge of the auxiliary fence must touch the square at both points.

When properly aligned, the device is held with C-clamps and the tenon cuts may then be made. The operator must be careful to hold the stock snugly against the auxiliary fence as it passes through the saw.—A. V. COMINGS.

NOISE-MAKERS FROM RYE AND WHEAT STALKS

MANY boys have never learned the old trick of making a sort of whistle from a stalk of rye or wheat. Simply pull off the leaf around the upper joint of the stalk and cut the stalk as indicated. Then use a sharp penknite to cut a narrow tongue close to the joint end. This

curious little instrument is blown by placing the lower end —that with the vibrating tongue—in one's mouth.—G. S.

The EXPERT

SHARPEN A CHISEL



Hold your chisel as shown, and take even, smooth strokes until a "butt" or wire edge is created. Do this on the coarse-grit side of The Carborundum Brand Stone.

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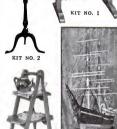
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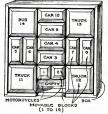
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CAN YOU SHOW GUS AND JOE HOW TO SOLVE THIS PUZZLE?

HERE is a plan of the Model Garage after Gus and Joe have put in a particularly strenuous day. They are at home relaxing, but as usual they have left the garage all spick and span, cars packed in closely, and locked up for the night.

But trouble is on its way! The bus driver has received a hurry call to get his bus out and go to the railroad station for some stranded travelers. Of course, his bus would be right at the back of the garage. Can you help Gus and Joe in this emergency to move the bus over to the doorway, ready to run right out?



The problem is to move the bus (No. 14) to the "doorway" simply by shifting the blocks

You can do it without taking any cars out of the garage and without turning a single one.

The puzzle is worked with fourteen pieces cut from wood or cardboard; they may be of any convenient size providing the proportions are as shown. Thin wood blocks are easier to shift around than cardboard, and they may be left plain or finished neatly with beveled edges. Give each block its identifying name and number. Then prepare a shallow box or tray to hold the puzzle.

The object is to move the bus (block No. 14) to the garage door—the space now partly occupied by motorcycles Nos. 1 and 2—without removing any block from the tray. The blocks must not be turned. For example, car No. 6 cannot be turned to a position like that of car No. 5.

After many attempts to better this record, a shorter solution in fifty-nine moves was discovered. Perhaps you can find that one, too. Here is a hint: do not move truck No. 13 at all.—ERIC B. ROBERTS.



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IN THE HOME WORKSHOP



The kit ready for use with mold open. Four small patterns are lying on the board in center

PART ONE - The Foundry Box By Joseph C. Gilbert

MALL castings of lead, type metal, aluminum, and various nonferrous alloys, including even brass and bronze, can easily be made at low cost in the home workshop with a small cast-ing outfit such as that illustrated.

Many broken mechanical parts can be duplicated and replaced simply by using the broken pieces, temporarily glued together, as a pattern for molding. The model maker, too, may make real cast-ings instead of using imitations for the metal parts of his models, and the experimenter and inventor can cast and recast until perfection is attained. All the equipment required for an outfit suitable for this work does not cost two dollars, and any handy man can make the kit.

One of the accompanying photographs shows the home foundry box closed; another shows it open with all the equipment



and tools inside; the third shows a complete mold opened and with four small patterns on the board resting between the cope and drag; and the fourth, on the following page, shows the flask on the lid in position for molding.

Among the parts the author has cast with this equipment are the fittings for several Spanish galleons and other ship models, an aluminum handle for a carving knife, a crank shaft, a 9-in. propeller blade, and small anchors and cannons.

The box is so designed as to keep everything needed within one unit that can be moved and stored anywhere. It also prevents the loss of sand caused by spilling it on the bench and tracking it over the floor.

A ready-made box is used, but it is altered as shown in the drawing. The over-all size is 11 by 14 by 22 in., and the stock is 1 in. thick throughout. The back and top, however, could be thinner; in fact, 1/2in. stock would be heavy enough for them. First the box is nailed all around excepting along the lower front corner where the hinges are to be fitted for the lid. When this has been done, line off the ends and top

-6" - 6" - 2" - BEND ON DOTTED LINE SOLDER AT CUT ON THIS LINE CLOSED OPEN-GUARD OF THIN WOOD HOOKS MADE OF TWO 4 x 12 IRON RODS BENT AT OR TIN) BOTH ENDS TURNED BACK

The box is cut apart and hinged as shown at A and B, and the tin sand bin made from an old oil can as at C





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Another view of the kit which shows where the flask is placed on the lid for molding

as indicated at A. Cuts are then made along these lines, and the parts are hinged so that they will open as shown at B.

Note the two guards or filling pieces of thin wood or tin; they are turned back

before the lid is closed.

The bin for the sand is made from a 5-gal, oil can by cutting it as suggested at C. The 3 in. wide flap at the back is bent forward and soldered at each side where it meets the ends. It is best to paint the inside of the bin to prevent the tin from rusting.

In two articles to follow, Mr. Gilbert, who has had thirty-three years of practical experience in foundry practice, will explain what foundry equipment is required in a home workshop outfit and tell exactly how to make small castings.

A SCREENED WASH PAN FOR SMALL PARTS



WHEREVER a large number of small machine screws and parts have to be washed in gasoline to remove grease and grime, as in garages and repair shops, valuable pieces are often lost or overlooked and thrown away with the used gasoline. To avoid this, a repair shop mechanic soldered a section of heavy screen wire over part of the top of the wash pan as illustrated above. Small parts can be placed on the screen for washing with a brush. The same screen also serves to salvage any parts accidentally left in the pan.—G. E. HENDRICKSON.



What strangs powers did the end-ents poisses? Where was the source of low-wideg their made it possible for them to perform micelas? Were these prefoond secrets bounded with successful flowing, or we they busined bounded with the stranger of the past base the mysteries of fife, and procomal power. This wideben is not lost,—it is withhold from the mass. It is offered frostly TO VOII with one person mind, you wish to stipp used the stranger of the past with to stipp used the stranger of the past existence and bAASER YOUR LIFE.

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Two energetic boys can earn extra pocket money by doing nickel plating for neighbors

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Nickel Plating

By R. H. ROGERS

NY boy who has a battery charger of the "tungar" type in his home can do practical nickel plating for fun or profit. Experimenters, too, should be interested in this electrochemical

process, especially as it employs a vacuum tube. The work turned out is of standard commercial quality.

To do nickel plating one must have a source of low voltage, direct current electric power, a tub or jar, and some nickel salts and nickel castings, called "anodes," which can be obtained from dealers in electroplating supplies. The battery charger furnishes the direct current at the proper voltage from the alternating current house circuit. An old battery box, a sawed-off wooden ice cream tub, or an earthenware crock will serve for the elec-

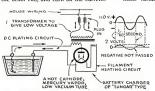
trolytic cell. Make up the solution according to the instructions which accompany the salts and put it in the cell. Lay two rods across the top (old brass curtain rods are satisfactory) and hang the anodes on one and the objects to be plated on the other. Suspend the articles on copper wires and see that the solution covers them. Connect the positive (+) lead from the 2/4-volt tap on the battery charger to the anode rod, and the negative (-) lead to the other rod, and turn on the current.

In a period of from one quarter to half an hour or less, depending upon the voltage used and the surface area of the particles, a fine hard coating of nickel will be found securely plated on the work. A heavy, long-wearing coating is white or gray-white and dull, therefore a small motor and cloth buffing wheel are needed for giving the objects a high polish. Thinner plating-that put on in a shorter time -has a good gloss without buffing, provided the work was originally smooth.

Articles to be plated should be thor-oughly scrubbed with a strong washing powder and well rinsed. The test is to see if water adheres to the whole surface; if it does, the solution will make a good contact and a satisfactory plating job will result. The rods should be rubbed occasionally with sandpaper to insure a perfect contact. No two articles should touch each other in the solution, nor should they touch the anodes.

There are many things about the home that can be improved in appearance and made tarnish-proof through nickel plat-

ing-radio parts, automo-bile and bicycle parts, plumbing fixtures, tableware, door and window hardware, fine tools, boat fittings, and the like. In fact, there is no reason why a boy cannot earn extra money by doing plating for neighbors and neighborhood business concerns. The charger will then do double duty-keeping batteries in good shape and providing current for plating.



Diagrams showing the connections for electroplating and why the battery charger gives current suitable for plating



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It is seldom that anyone becomes a writer until he (or she) has been writing for some time. That is why so many authors and writers spring up out of the newspaper business.

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which at the same time develops in you the power to make your feelings articulate.

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HIGH-FLYING PLANES TO RACE SUN

(Continued from page 14)

closing an air-tight hatch behind him, and the machine continues its upward climb with compressors driving fresh air at sea level pressure into the cabin.

In the lunkers craft, the compressor is driven by a windmill outside the ship. Thus, independent of the engine, it continues functioning even if the motor stops. Another feature of this machine is a special apparatus that draws off carbon dioxide from the sealed cabin during a flight. All the stratosphere ships will carry reserve tanks of oxygen that can be turned on in an emergency if the com-pressors fail. Throughout the journey, the pressure and oxygen content of the air inside will be kept constant. To prevent air leaks, the moving control wires will leave the cabin through rubber openings and boxes of oil.

Because internal pressure will be far greater than external, at the peak of the climb, the cabins are specially reënforced to prevent them from exploding outward as a deep-sea fish bursts when brought to the surface.

For every mile a plane climbs into the air, until it reaches the stratosphere, the temperature drops about fifteen degrees. Throughout the stratosphere, the temperature is believed to remain constant at about seventy-five de-grees below zero, Fahrenheit. Finding new alloys to stand this bitter cold was another problem the engineers had to solve. Ordinary hard metals become brittle and fragile at low temperatures and so are unsuited for use in the vital parts of a stratosphere ship.

PROVIDING heat for the cabins, however, automatically takes care of itself, compressors turn at such speeds that the friction of the blades on the air heat it while it is being driven inside. At some altitudes, the air coming from the compressors is expected to be too hot and special radiators are provided to cool it.

All three of the machines will use fourbladed propellers of huge diameter to grip the thin air. The 430-horsepower inverted "V" engine on the sixty-one-foot Farman plane will turn a fifteen-foot forged-steel propeller with blades of variable pitch. As the machine mounts, the pilot can turn the blades to a greater angle so they will grip more air.

Supplying oxygen to the motors is almost as important as supplying it to the cabins. For the power developed depends upon it. Superchargers, forcing air into the cylinders under high pressure, will keep up the efficiency of the stratosphere engines in the rarefied atmosphere in which they will operate. The 800-horsepower motor on the low-wing, sixtysou-norsepower motor on the low-wing, saxly-foot-span Junkers monoplane, and the eighteen-cylinder, 700-horsepower engine of Guerchais' craft, will both receive the com-pressed air from single superchargers. On the arman plane, a battery of three smaller ones rarman plane, a battery of three smalet ones will go into action one after the other as the machine ascends. The first will begin work at 20,000 feet, the second at 30,000 feet, and the last at 48,000 feet. All three will be turning 25,000 revolutions a minute as the plane passes the 50,000-foot level.

IN A test tank at the Farman plant, the motor developed 300 horsepower when the air pressure and oxygen content were reduced to approximately those found at an altitude of 62,000 feet. The perfection of new super-chargers is expected to lift the ceiling for thin-air planes to between 60,000 and 80,000

Not long ago, the Italian engineer, Italo Raffaelli, announced he has designed a steam turbine that will actually give more power as it ascends, thus making it ideal for use on the high-altitude air lines of the future. His engine weighs nine pounds per horsepower and uses naphtha for fuel.

Another suggestion for adding to the power of a plane at high levels has just been advanced by a German scientist. Since the drop in pressure between the exhaust gases and the surrounding air would be very great in the stratosphere, he points out, the engine might carry an exhaust-gas turbine to give extra power during such flights.

Long distance air raids by stratosphere planes are visioned as a feature of the next war. Military authorities, as well as air transport operators, are watching closely the tests under way. In fact, the French Air Ministry is actively cooperating with the Farman plant in the development of its machine.

Construction of the three planes now being groomed for the spectacular race to reach the stratosphere was begun soon after the Swiss scientist, Auguste Piccard, and a companion, in May, 1931, soared to a height of 51,775 feet in an air-tight aluminum ball slung beneath a balloon inflated with half a million cubic feet of lifting gas. Data collected by this Columbus of the upper air aided designers in their work. Early this spring, Piccard be-gan preparations for his second voyage into the unknown for further observations.

THE highest point in the sky at which THE highest point in the say at minute any record has been made is something over twenty miles, reached by small sounding balloons of the Weather Bureau. The record for airplanes-43,166 feet, set in 1931 by Lieut, Apollo Soucek of the U. S. Navyfalls more than a mile short of the lower fringes of the stratosphere,

Penetrating these upper reaches, where planes may some day race the sun around the earth, is the next important stride in flying. The trail-blazing machines of two nations, now tuned up in Europe, promise to lead the way to this new realm of travel.

USE BAKED POTATO IN REFINING GOLD

REFINING gold with a baked potato is the unusual method employed by some amateur gold hunters who, because of unemployment, are making a living by extracting small quantities of the precious metal from the sand of streams in the west. The specks of gold are first removed from the sand by amalgamating them with mercury. A small quantity of the amalgam is then placed in the heart of a large potato. After the potato has been baked until the mercury has evaporated, the ashes are panned for the pure gold, In larger quantities, the quicksilver is evaporated from the amalgam by using a retort

NEW MACHINE COUNTS TINY GRAINS OF SAND

A DEVICE that counts sand grains has been invented for the analysis of sediments by J. E. Appel, University of Chicago geologist. Fitting on the end of a suction hose, it is equipped with a thin brass plate containing 300 minute holes. Since the holes are smaller in diameter than the grains being counted, a single grain is attracted to each hole and is held there by suction. When every hole is need there by suction, when every hole is holding a grain, the sand is carried off to a separate pile and another 300 grains picked of counting has been done either with the new device as many as 10,000 sand grains an hour may be counted.

HELP YOURSELF TO A HOME

(Continued from page 21)

weary of the city, so he wrote to the register of lands at Los Angeles asking where, in California, he could find land to homestead.

In reply the register sent him a list of all counties in California with the character of the lands set forth; level, grazing, desert, timbered, mountainous, agricultural,

He found in the envelope, also, a booklet entitled "Suggestions to Homesteaders and Persons Desiring to Make Homestead Entries," in which he found a paragraph informing him he first should pick out the land on which he desired to enter, then obtain from the land office a township plat showing what lands in that particular area were available. Having definitely located the plot, he again went on the land, prepared affidavits swearing he was acquainted with the land, that it was neither mineral nor saline, that he was capable of improving the land, that he was acting for himself and would in good faith make his home there.

Within six months he was required to make his home on the quarter-section selected, and thereafter to make his residence on the land in accordance with the rules,

OSBORNE didn't wait for six months to clapse, however. Within a week he had rolled his bedding and, with Mrs. Osborne, drove his automobile across the mountains to the site of his new home.

Slowly he cleared one corner of his tract. Meantime he built the two-room shack that today serves as home and store for he, too, found he had located on an occasionally-traveled desert "highway" and could cash in on the wants of his neighbors.

Uncle Sam told him he would be required to have crops growing on at least ten acres by the end of the second year, and on twenty acres in the third year. So down went a well a thousand feet west of his home, near a depression on the property, and there he

grows his crops.
"The trouble with most homesteaders," Osborne told me recently, "lies not in the land but in themselves. The novelty of fighting with nature wears off, and some give up. If they only would come with moderate capital, a few hundred dollars, they would find they can make a go of it.

HOMESTEADERS can help guarantee their own success if they will bear in mind these simple but important rules:

1-Go on the land during the most unfavorable season of the year and study its characteristics.

2-Learn when and in what quantities rain falls

3-Learn whether you are picking land in a frost belt and how cold the winters may be.

4—Talk to the natives of the neighbor-

hood, particularly the old-timers, for they can tell you more about the land than Uncle Sam.

5-Above all, study the soil and water supply. In some regions state universities can supply helpful information.

6—Don't expect a big crop during your first year on the land, and be prepared to stick out the first seven months with plenty of food and a substantial tent or cabin.

Exactly what part of the remaining two hundred millions of acres are suitable for homesteading no one knows, not even Uncle Sam. Fifty million acres have not even been surveyed. You'll find 346,037,591 acres in Alaska; 51,399,000 acres in Nevada, which leads the other states in available acreage; 25,157,000 acres in Utah; 16,046,000 acres in California

With the re- (Continued on page 98)

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HELP YOURSELF TO A HOME

(Continued from page 97)

cently increased demand for homestead acres, some people have shown a fine disregard for the rights of others. The most audacious attempt at stealing, or strong-arming land, has appeared in Los Angeles where more than 2,500 applications for homesteads on old Mexican land grants have been rejected by the land office.

The nearly 3,000 people who have literally demanded that Uncle Sam turn these valuable properties over to them disregard the ruling of the U. S. District Courts in California that these Mexican land grants, issued before the United States purchased California, are valid. Such was the clamor, in fact, that only re-cently Senator Bratton, on behalf of the Senate Committee on Public Lands and Surveys, reported that these old grants were legal and valid and that land-hungry applicants waste their time and money in trying to raid California cities and ranches, hoping to homestead tracts worth, in some instances, a hundred million dollars.

B-CURRENT FOR YOUR RADIO

(Continued from page 57)

of the B-supply portion of the transmitter. Remember, the law requires that the Bsupply of amateur transmitters shall be filsupply of amateur transmitters shall be in-tered direct current, and if the single two-microfarad condenser at C, which should have at least a thousand-volt rating, does not give sufficient filtering action, a filter choke coil and another condenser can be added as in Fig. 1.

Of course it is obvious that more power can be obtained from the B-supply of either Fig. 1 or Fig. 2 if a twelve-volt storage battery is used instead of a six-volt unit. In case the current in amperes drawn from the battery will be many times the actual current obtainable from the secondary or B-

The cost of building a power unit of either type will be quite low. Old spark cols can be bought for very little and 201A tubes or a gaseous rectifier tube are also low priced.

If you prefer the buzzer interrupter circuit of Fig. 1, it should be possible to make the interrupter itself out of an old electric bell by rewinding with much heavier wire and fitting a long spring armature. If the armature vibrates too slowly, cut it off, a piece at a time, till you get the equivalent of sixty-cycle operation.

"PHON" IS UNIT USED IN MEASURING SOUND

LATEST among the words to join the vo-cabulary of science is "phon," a unit of a unit of sound devised at the Berlin Institute of Technology, in Germany. Research workers at the Institute are busy classifying sounds ranging from the yelp of a dog to the roar of a locomotive, according to their strength in phons. The trill of a nightingale, they found, has a strength of twenty phons; a spouting has a strength of twenty phons; a spouting fountain, fifty phons; an automobile horn, ninety phons; and a motorcycle with the muffler cut out, 102 phons. All common noises, the experiments indicate, can be classified between one and 130 phons. Any noise above 130 phons causes pain in the ears of the auditor. The new unit is expected to prove valuable in providing a standard gage for classifying city noises and for referring to the strength of sounds in lawsuits,

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ROBBERIES ON A GIGANTIC SCALE

(Continued from page 47)

gers, but the judge failed to see the funny side. gers, but the judge tained to see the runny suc-At Morristown, N. J., a new \$4,000 fire engine was purchased for the volunteer fire de-partment. Three days later a small boy re-ported it missing from the fire hall. A frantic search discovered it in the woods, six miles away, and undamaged.

Celebrating July Fourth a couple of years locomotive. He knew nothing about driving locomotives, but he climbed into the cab, and a few minutes later had it on the main line. A modern safety device cut short his joy ride by tripping a lever and bringing the engine to a stop before it could wreck a speeding express.

The celebrant got off with a fine o. \$50.

AHUMBLE "gob," late of Uncle Sam's Navy, beat this last example of absentminded borrowing, Tired of life in the Philippines, this sailor climbed aboard the Intrepid, a yacht that was lying at anchor, Having considerable skill as engineer and navigator, the sailor headed for the nearest point in China, and was well on his way before the yacht was missed. Two roaring Navy seaplanes spotted the yacht steaming merrily along about sixteen miles out.

A similar affair brought a one-legged Minneapolis newsboy to grief. He was found in a bunk, half dead from seasickness, in the stolen yacht Jaloma, sixty miles out in the Atlantic! Arrested for grand larceny, he told an apparently straightforward tale of being persuaded to go for a trip to see yacht races off Newport, the goodlooking stranger failing to mention that he was stealing the yacht. The latter, after lashing the wheel and setting all sails, had deserted his seasick passenger and set off for shore in a tender. He may have been lost at sea, as a thick fog enveloped the region; and the yacht, sailing in circles, was nearly run down by a fishing trawler.

More disastrous was the yacht-stealing case of Frank Pollo, who stole a yacht in New York. No one knew where it had gone, and it was a great mystery until found wrecked on an island off the north coast of Holland, last October. The man, found dead, apparently had made the transatlantic crossing alone in the motored sailing yacht. Overtaken by a storm, he probably had been driven ashore.

ALL these instances of mass production in Athievery fade into insignificance before the exploits of European masters, who do not de-pend entirely on their own efforts. In one small country, a firm was employed to build a tunnel, in territory formerly Austrian, For seven years regular reports showed the progress of the tunnel, men employed, material removed, and so on. The government paid the contract price, and at the grand opening officials found a few workmen cleaning up the débris. The tunnel was there and the contractors were congratulated.

An engineer, celebrating too boisterously the completion of his arduous task, proved the undoing of these "contractors." He re-vealed that the tunnel had been dug six years previously by Austrian and German troops, who had abandoned it when the war front shifted. The firm had received five and a half million dollars for digging a hole in the ground that already existed!

If that seems incredible, what of the discovery announced a few years ago by the Prime Minister of Rumania? He reported that an entire railroad-rails, ties, switches, spikes, even rolling stock and signal system—had completely disappeared! Constructed in war-time, from Cluj, Transylvania, to Jacobeni, Rumania, it was said to have cost almost four million dollars. Apparently it had been dismantled piecemeal and the parts sold without exciting suspicion.

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CAR'S AMMETER CAN WARN OF IGNITION TROUBLE

(Continued from page 60)

thing that keeps it from burning up is the fact that it only has to run for a few seconds at a time,

"Now the generator is a different proposition. It's on the job as long as the engine is running above idling speed. So it's designed to produce not over eighteen or twenty amperes and it keeps the battery charged only because it runs a lot longer than the starter motor. If you tried to make a regular size generator produce more current than about twenty amperes, it would soon burn out.

"Mechanically, too, there are differences. The bearings on a starter motor are pretty crude because they don't have to stand steady running. Generator bearings, being made for continuous use, are much more durable, The copper brushes needed to cut down

the resistance and let lots of current through the self starter motor windings are not nearly as good for steady use as the graphite carbon brushes used on the generator."

"HAT reminds me," Dilbow cut in. "The THAT reminds me, Dibow cut in self starter on my old car doesn't always work. Sometimes when I step on the pedal it turns the motor over in a sort of a rough, bumpy way. The next time, it won't stir at all. What's the matter?"

'Turn on the headlights and watch the ammeter when you step on the starter," Gus advised. "If the starter takes hold and the needle flickers to beat the band or the starter doesn't work at all and the needle stays still, probably the self-starter commutator is worn and burned so badly the brushes

only make contact part of the time. "There are other things the ammeter needle tells you about your electrical system,"
Gus went on. "It shows you whether
or not the generator cut-out is working, besides telling you when the generator is on the job. It tells when one headlight burns out by the difference in the needle position. It shows you what happens when you move the third brush and how much to move it to get the result you want. If the motor suddenly cuts out when you're breezing along, a quick glance at the ammeter will tell you whether to look for a break in the primary ignition wiring, something gone wrong with the breaker points, a burned out condenser, a shorted distributor head."

"How do you tell that?" Dilbow asked

side. If the primary circuit is open or the breaker points have backed away so they don't touch or they're burned so badly they don't let any current through, the needle goes right back to zero. If the needle acts as usual, you can be sure that the contacts are working and the trouble must be in the condenser, the high tension winding of the coil, the high tension wire from the coil to the distributor,

or the distributor head.
"See how this all brings you right back to this new invention of yours," Gus added, fingering the drawing. "You'd never have wasted any time on this idea if you'd figured out what the ammeter shows. It's really like a gage you could put on a water pipe to show you how much water is flowing."

"I get you," Dilbow observed, "The

starter motor uses electricity by the bucketful for just a few seconds and the generator puts it back, a spoonful at a time, and the only reason it works at all is because the generator is on the job all the time."

Slowly he tore the brown paper plan into long, thin strips. "I guess I won't waste any more time trying to get something for nothing!" he decided.

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OUT OF THE AIR ON A

(Continued from page 37)

of the watch and when the excitement ended the hero of the day was the pilot parachute. A week after New Year's in 1924, I was flying a "Jenny" biplane, with an OX motor, east of Indianapolis, Ind. Heavy snow clouds

east of Indianapolis, Ind. Heavy snow clouds were piled low in the sky. At frequent intervals drifting fingers of fog hung down.

vals dritting ingers of log hung down.

About 4:50 is began to grow dusky. was
About 4:50 is began to grow dusky.

Ohio, before dark. East of all the description,
the log fingers became more frequent. It
had burst through three in rapid succession
and was coming out of the fourth when the
ship suddenly seemed to strike a stone wall
in the air. I was catapulted against the
in the air I was catapulted against the
The plane trembled all over a careed shyward,
and then began to fall.

Another barnstormer, racing toward Indianapolis, had crashed into my ship without seeing me. Flying a few feet above me, his landing gear had struck my upper wing head-on, smashing it back over the cockpit like a lid on a pot, pinning me in.

I FOUGHT to push the wing away and jump. It was tipped up at a steep angle and the pressure of the wind glued it in place. A giant couldn't have budged it. The opening between the wing and the front of the cockpit was too narrow to worm through. All this time, the ship was falline.

I kicked through the canvas side of the fuselage and tried to wiggle out backward under the inverted V of the crossed bracing wires. The space was just too small. One wire leg of the inverted V pressed against the back of my scalp, the other dug into the back of my ankles. Doubled up like a jack-induction of the control of the property of the control of the contro

The seat-type parachute I was wearing was ustified the Issael, I took a last desperate chance. Pushing over the rudder bar with my hand, so the ship sideslipped violently away, I ferked the rip ord. The silk, trailing after the pilot 'chute, streamed away from the plane. II popped me out the opening, scraping chunks of skin from the back of my heels and scalb, but pulling me free.

my nees and scalp, but pulling me free.

It seemed only a second before I landed hard on a snow-covered field beside the railroad, where the other flyer scraped to a safe landing on the bottom of his fuselage. I had broken out of the ship at less than 600 feet. Although I was joited and sore for a week afterwards, I had descaped, thanks to the quick opening of the silk, dragged out by the pilot chute.

THAT was the lowest jump I ever made.

"The higher, the safer," is an old saying among professional parachute men. In exhibition drops, they rarely dive off a plane below 2,000 feet. Then, if anything happens they have time to work the 'chute open before they hit. Once a veteran said to me: "Never quit fighting a parachute if it doesn't open right saws."

I remembered that bit of advice later on I remembered that bit of advice later on during an air circus in northern New York. At 2,000 feet, I dropped from a wing and reached for the rip cord ring, located on the heads of the partners. I sugged harder. Still it stuck. I be used to be sugged harder. Still it stuck. I had the sugged harder Still it stuck. I had the sugged harder will open the chute. I plunged nearly 900 feet before the total open the chute. I plunged nearly 900 feet before.

the 'chute. 1 plunged nearly 900 rect before it was open.

In a long fall, a jumper tenses the muscles of his chest and shoulders just as the 'chute opens to take the shock of the sudden jerk in slowing down. Most people think a paracher of the person of the people of the people of the on unbrelle. As a matter of fact, moving (Continued on 1962 102)

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OUT OF THE AIR ON A BAG OF SILK

(Continued from page 101)

pictures of 'chutes opening in the air show that they fill at the center first, the edges spreading out last of all. Thus, they begin to slow down before the whole expanse of silk is open. When a jumper is upside down in the air as he jerks the ring, this initial slowing down turns him right side up before the big jerk comes. Otherwise, the sudden snap might break his neck. Incidentally, it is a wise thing to keep your teeth set until the parachute is open, otherwise the jerk may make you bite your tongue.

Dan Smith, the famous Army jumper who

made more than 1,500 parachute drops from planes, used to take 300-foot swan-dives into space from the wings of my ship at Rochester, N. Y. At the time he was doing parachute work for the Reynolds Airways. His favorite method of taking off was to make a cartwheel from the wing, spinning head over heels until he jerked the rip cord.

During one of his first jumps in the Army, Smith had a breath-taking escape when he fell through the tail of a De Havilland biplane He was crawling out on the wing for a jump when he slipped and fell. At the same instant, when he supped and rell. At the same instant, for some unknown reason, the pilot pulled up the nose of the ship into a climb, dropping the tall. Smith crashed into it, breaking his nose and bruising himself in a dozen places. Only half conscious, he clung to the streamlined bracing wires until they cut his hands to the bone. When he was sure his parachute was not hung up anywhere, he dropped from the tail, jerked the ring, and made a safe landing.

BECAUSE a parachute streams up seventy feet or more when the pack is opened, the jumper must wait until he is more than that distance below the plane before he jerks the rip cord. Usually beginners are told to count three slowly before they reach for the ring. If the parachute is opened too soon, it is likely to foul on the tail of the plane and

Army airmen making their first jumps are given two 'chutes and carry a knife in a special pocket attached to the harness. Then if one parachute fouls, they can cut the shroud lines and descend safely with the second.

Another recent requirement is that service men make at least one jump with a parachute which they have packed themselves.

Sometimes, in exhibition leaps, men come

down with two or more 'chutes open. remember once last summer, Joe Crane, the famous jumper at Roosevelt Field, L. I., drifted down with four open at once. In such a jump, no two rip cords are pulled at the same time. Each 'chute is opened separately to prevent fouling,

WHEN a jumper is carried out over a lake or river, he should swim as far as possible underwater in the direction from which the wind is blowing before coming to the surface. If he comes up under the parachute, there is danger of becoming tangled in the shroud lines and drowning. Dan Smith used to unbuckle his harness, hang by the arm loops and then, when within fiften feet of the water, make a high dive into it, letting the 'chute come down by itself. Ironically enough, it was in water that Smith met his death. He is believed to have been attacked by cramps when he landed in the swirling currents of the Delaware River, during a jump

currents of the Delaware River, during a jump at Port Jervis, N. Y., last year. At least 100 times I have piloted ships from which parachute jumpers took off. Of all these jumps, probably the queerest was made at Roosevelt Field by Buddy Bushmover dressed in a huge white Easter rabbit suit, with ears a yard long. We picked a spot for the jump that would take him right over the grandstand at Roosevelt Field and he had the time of his life wiggling his ears at the children in the audience as he sailed overhead.

In spot landing contests at air meets, jumpers leap from an altitude of 1.500 feet to see which one can land nearest the center of a 400-foot circle. Some start almost over the circle and make a delayed drop, falling 800 or 1.000 feet before pulling the ring. This gives the wind less time to drift them away from the mark. Others start farther from the mark, open their parachutes as soon as they are clear of the ship, and try to maneuver into the circle during the long descent.

This is done by steering or "slipping" the

chute by pulling down on the lines on the side toward which you want to move. For every 100 feet you descend, you can slip your 'chute ten or more feet horizontally in any desired direction. Sometimes, when a jumper is landing in a strong wind, he slips his parachute into the wind just before he touches ground. This reduces the speed at which he strikes and lessens the chances of injury.

ONE of the best bits of parachute maneuvering I remember was performed last year by Joe Crane. He placed a friend near the center of Roosevelt Field and then came down from 2,500 feet steering his silk um-brella so accurately that, if his friend had not moved, he would have planted his feet on his shoulders.

on his shoulders.

The most thrilling jump I ever experienced
was when I joined the Caterpillar Club
officially over Georgia in the crash of the
ill-fated "K," two years ago. In this big snow-white monoplane, I left Roosevelt Field, L. I., with two companions, Jimmy Garrigan and Garland Peed, in an attempt to fly non-stop from New York to Buenos Aires, Argentina.

We took off at dusk. Heading south we ran into rain and mist, then struck fog. For more than eight hours, we flew blind, battling through air as thick as cotton hatting. At three o'clock in the morning, the left wing began to drag. Then a long ominous crack, splitting the ceiling of the cabin, appeared over our heads. The doomed ship was pulling apart. There was only one thing to do-jump,

Garrigan went first, at 5,000 feet. Peed and I bailed out next, leaving the ship at 2,500 feet. I tried to get out the cabin door. The strain on the fuselage had twisted it, jamming the door tight. I couldn't budge it. I kicked a hole in the window of the fuselage and wiggled through. The wind caught me, whirled me around, crashed me against one of the steel wing struts. Then, I dropped into the thick fog,

WHEN clear of the falling plane, I tried to reach across with my right hand to jerk the ring. I couldn't move my arm. force of striking the strut had dislocated my shoulder. While I ripped downward through should hundreds of feet of fog, I struggled to hook the thumb of my left hand through the ring. When I got it in, I pushed the ring across my chest and the parachute popped into full bloom, Just In time.

At present, only Army and Navy flying schools require students to make parachute jumps as part of their training. Some day, I believe all flying schools will include such descents as part of the work toward a pilot's license. Knowing how to handle a parachute and make a jump is as important to an airman as knowing how to swim is to a sailor,





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OCTOBER, 1932

This seal on an advertisement signifies the approval of POPULAR SCIENCE INSTITUTE OF STANDARDS

How Jungle Beasts Live Near Big Cities

(Continued from page 27)

drinks water, the corn swells, and digestive disturbances result.

When evening comes after a busy day, if all the animals are still sale and sound, the keepers heave a sigh of relief. But they can never be sure until they check up. Not long ago, after the day's excitement had died down at the elephant house, the New York keepers heard "Peter the Great" making strange hiccoughing sounds in his pen outside. They rushed out just in time to pull a pop bottle from the hippo's throat and prevent if

Special precautions are taken to keep meateating arimals from choking on their food. Every piece of horse meat or beef that is tossed into a cage has a bone in it. If solid meat were given the big cats. I was told, they would swallow the chunks whole and strangle. By having to tear the meat from the bones, they get it in small shreds.

At night, when the bear dens are silent and the monkey house has quieted down, activity begins in the reptile house. Feeding starts about eight o'clock. Rahbits, rats, guinea pigs, frogs, tadpoles, day-old chicks and occasionally a young pig are on the menu. Every ten days, the Regal pythons feast on ten chickens or a small pig. For three or four muths the Control of the control

ONCE a week, the king cobra dines on a plump five-foot gopher snake. This cobra refuses to eat anything but snakes, so a man in Texas has a standing order for approximately 250 feet of gopher snakes a proportion of the control of t

once in seven days.

In the daytime, when most of the snakes are sleeping, the lizards and turtles that live in the reptile house have their meals. The showy little green lizards gobile down mealworms; the iguansa nibble bannan; the monitors swallow fresh eggs whole without hreaking the shells; and, three times a week, and the shells; and shells; and shell shells; and shell shell shells; and shell she

A bird house alone requires a wider variety of foodstuffs than the Waldorf-Astoria. The bill of fare ranges from horse meat to thistle seeds and includes cottage cheese, and ecces, zwieback, chickweed, raisins, milk powder, cabbage, honey, and dried files! "Mealworm ranches" at New York produce half a million wiry little worms a year for the birds. Special mills roll and crack grain and an extensive At the Washington, D. C., park, special fly-farms, consisting of wire-mesh boxes, turn out flies for the lizards and birds.

RECENTLY, a ruby-throated humming bird set a new record by living three years and four months in captivity at Bronx Park. The previous mark, established at a western zoo, was two years and a half. In place of the natural food of these little birds, the nectar of flowers, they are fed on a mix-humber of the natural food of the place of the natural food of the place of the property of the natural food of the place of the property of the natural food of the place of the natural food of the natural food of the place of the natural food of the n

One of the problems of feeding that requires much research and experimenting is finding substitutes for the natural fare of rare specimens. For instance, ant caters are no longer fed ants in the zoo. They get milk into which is stirred eggs, oatmeal and finelyscraped beef. This diet, developed at Bronx Park after four years of research, supplies the needs of this strange animal and has been widely adopted at other zoos throughout the country.

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Special hospitals equipped with operating rooms, isolation wards, diet kitchens, research and diagnosis laboratories, and mortuaries are part of the equipment of many parks. Here cuts and scratches are dosed with iodine, X-rays made, broken legs set in splints, teeth examined, and operations per-

Cash Prizes for PHOTOGRAPHS

In NEXT month's issue begins a novel and interesting cash prize contest open to amateur photographers. Anyone may compete, for the rules of the contest give either beginner or expert an equal chance to win a prize. Full details will be published in the November issue, on sale October 1.

formed while the animals are under the influence of ether or local anesthetic.

N EARLY fifty drugs and remedies are used at the New York park's animal hospital, including cascara tablets, mustard plasters, cough syrup, Epsom salts, and half a dozen antiseptics. Every new arrival at weeks to the sure it has no contagious disease or unusual parasites. One research man spends his time studying and classifying parasites. Last year, he discovered a hitherto-unknown type of round worm in a Branick

When deer in one western park became troubled with internal parasites, not long areo, it was found the worms were entering their bodies by way of june-buy eggs which they were eating with grass in the pasture. The deer were switched to hay and the pasture was burned over with blowtorches to destroy the eggs.

in the companies of the

WHENEVER an animal dies at a park, its cage is thoroughly disinfected and a post-mortem examination performed to

determine the cause of death. Such an examination, last year, revealed that the world's biggest captive elephant, "Khartoum," had died of heart trouble.

died of neart troune.

Weighing 10,000 pounds, this twenty-eightyear-old African giant was the most destructive animal ever kept at Bronx park, A
special door that weighed a ton and a half
and worked with a worm screw had to be
fitted to his cage as he would tear an ordinary door from its hancers.

IN THE summer of 1922, the rarest specimen ever brought to an American zoo died after being on exhibition forty-nine days. It was a duck-billed platypus, a strange egg-laying mammal that had been brought 10,000 miles from Australia to New York

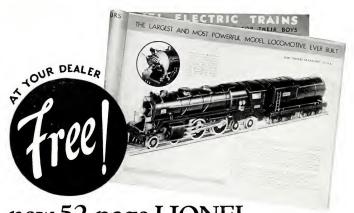
The duck-hill ate only strings, white grubs, and angleworms. In a single day, it would consume half a pound of angleworms, forty shrimps, and as many grubs. The cost of feeding the eighteen-inch animal, the only one to be brought alive from Australia, was approximately 85 a day. Recause of its nervous proached its tata kin perfect selence.

Twenty-five hundred dollars, or approximately SSO a pound, was paid for the duck-hill. That set a record for costly specimens. While "Mogul" is valued at \$25,000, this rhinocross weighs as much as a small switch-engine and so costs little per pound of rhino. "Jimmy" the shoehill "stork" costing the New York park \$1,400, holds high place among the birds for costliness.

At present, if you want a pair of Royal Bengal tigers, they will cost you \$5,000. Siberian tigers run as high as \$10,000 a pair. Jaguars come at \$500, leopards at from \$200 to \$300, lions at \$2,000 a pair. A half-grown Baird's tapir costs \$500, polar bear cubs, a year old, \$400; grizzly bear cubs, eight months old, \$300. Zebras sell for from \$1,000 to \$2,000 apiece. A two-year-old female African rhinoceros, forty-one inches high, has a market value of \$4,800, while an Indian rhino runs as high as \$7,000. Monkeys range all the as high as \$7,000. Monkeys range all the way from \$15 to \$500, according to their species; baboons from \$100 to \$300, chimpanzees from \$500 to \$900. Young gorillas sell for \$4,000 apiece. There aren't any old gorillas as they never live long in captivity.
When "N'gi" died last winter in Washington. despite efforts to save his life by administering oxygen, he was five years old and had lived longer than any other gorilla had ever lived in captivity in the U. S. A mandrill in full color will bring \$500 and a pygmy hippopotamus from \$3,000 to \$3,500.

Pythons come at so much a foot. A twenty-five-foot snake of this kind well foot \$1,000, or \$40 a foot. Cobras have a flat price of five British pounds, or \$25. King cobras, twelve feet long, feeth from \$150 to \$200. The rare blood python is priced at \$2,500. Rattlesnakes range from \$5 to \$8 with big eight-foot rattlers going as high as \$15. Emerald tree boas, "the birds of paradise of the snake house," sell for \$75\$, and the average small snake in a collection costs from \$5 to \$10. The price of lizards runs from \$10 to \$10. The price of lizards runs from continues and \$500 for the rare Komood 1sland "diraconoms," ten feet long.

AVIMALS come to a zoo in three ways. Most of them are bought directly from animal traders who either capture them in the field or buy them from native hunters. Others are donated by explorers who bring them back to civilization on their return from distant countries. And a few come in exchance for other specimen.



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